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Part 2

PRESIDENTIAL ADDRESS : 24 May, 1960 GEONEMERTES: A STUDY IN ISLAND LIFE

By C. F. A. PANTIN, F.R.S., Pres. L.S.

(With 4 Plates and 8 text-figures)

FOR nearly 20 years I have been studying a small group of small worms, the terrestrial nemertines. There are some ten well-described species ; all assigned at present to the genus *Geonemertes* Semper. There are also three other named species which are so inadequately described that no organisms could certainly be assigned to them. The genus is not of the slightest economic importance. Indeed in these days when the scientist is naturally expected to bend his energies to really useful things, like shooting rockets at the moon, some explanation is perhaps required for time spent upon creatures of such obscurity. I could of course give the immediate and wholly satisfactory answer that no natural phenomena whatever need any apology whatever for their study.

All the same the Society might care to hear some account of these animals ; for this small genus raises many interesting questions. What is the meaning of homology at the cellular and ultrastructural level ? How may the evolution of a group have been influenced by the dramatic changes in climate and in sea level during and after the Pleistocene ? What is the real relation of taxonomic character to evolutionary history ?

The Nemertina, or Rhynchocoela, to which these worms belong, is not a large phylum. It is almost exclusively marine. One genus, *Prostoma*, has successfully invaded the fresh waters of the world. The genus *Geonemertes* alone is terrestrial. The species of *Geonemertes* inhabit damp situations on land ranging from just above the high-tide mark to damp woodlands well inland.

Nemertine worms have a characteristic anatomical structure. Pl. 1, fig. 1, of *Prostoma graecense* (Böhmig), shows the typical long unsegmented body with a protrusible muscular proboscis lying above the long simple gut. In one Order, the Hoplonemertini, the proboscis is armed with a piercing stylet ; and there are sacs in which reserve stylets are secreted.

The brain is anterior, associated with four or more eyes, and with a pair of complex sense organs, the cerebral organs. The space between the gut and the muscular body wall is filled with watery connective tissue, as in another group of simple worms, the Turbellaria ; and as in these, within the connective tissue is a system of excretory nephridial tubes ending in ciliated 'flame cells' (Pl. 2, fig. 1).

Unlike the Turbellaria there is an elementary blood system of capillary vessels ; and unlike them also, the genital organs are simple sacs of sperm or eggs. The surface epithelium of the body is ciliated. Even the terrestrial *Geonemertes* move along by swimming in their own secreted mucus ; and when examined as museum specimens there is nothing about them to suggest that they are terrestrial, and do not belong to the sea like their marine relatives.

In 1935 Waterston & Quick (1937) identified a species *Geonemertes dendyi*

Dakin in a wild habitat in Wales, near Swansea (Pl. 1, fig. 2). The species was first recorded, not from Britain but in 1915 from Perth in Western Australia, by Dakin. That it is of Australian origin seems highly probable because two other closely related species *G. australiensis* Dendy, 1892, and *G. hillii* Hett, 1924, are also Australian, and because it has more distant but very important structural affinities with a New Zealand species, *G. novae-zealandiae* Dendy (1894, 1895) (Pl. 1, fig. 5), as I shall show later. That *Geonemertes dendyi* is an introduction into Britain is supported not only by its recent discovery here, but by the fact that, though this and other geonemertine species have been recorded in Europe before their discovery in Britain, they were always found in green-houses and botanical gardens (Stammer, 1934).



I have for many years hunted for *Geonemertes* in Britain, and the map shows its distribution (Text-fig. 1). Those sites marked with diagonal crosses have been examined by me so often that it is reasonably certain that these worms do not occur at them. There are many other sites in Britain and Scotland where occasional visits have also failed to discover the worms. But in 1943 I found *G. dendyi* in South Devon (Pantin, 1944) and since then I have numerous records indicated on the map. They occur between the Wirral Peninsula in Cheshire, round the west coast as far as the New Forest. They are also to be found at several sites round the Killarney peninsula in Eire. I have always found them within a few miles of the coast and near, or on the warm side of, the 5° C. isotherm for the mean January temperature. That is, they live in the warm damp coastal parts of these islands where frost is rare.

Despite its coastal distribution *G. dendyi* is rapidly killed by sea-water and therefore cannot have been distributed by the sea. If it is distributed by land, it seems strange that a naked ciliated mucus-secreting organism, so evidently liable to desiccation, should be nevertheless so well established. The eggs are laid in gelatinous capsules deposited in very damp places. They are even more liable to desiccation than the adult and cannot be a distributive phase (Pl. 1, figs 3 and 4) (Pantin, 1944). There is no resistant resting stage. But the adults

TEXT-FIG. 1

Distribution of *G. dendyi* in British Isles between 1937 and 1960. Records as black circles. Repeated failure to record $\times$ s at Cambridge, Marlborough, Chipping Campden, Forest of Dean, Wolmer Forest, Windermere, Scourie.

The following gives the first date of discovery, the locality and the name of the finder, for the records of *G. dendyi* in Britain given in the Text-fig. A few subsequent records are also included, and one record from the original site in Australia.

B = F. Rogers Brambell.

D = M. J. Durham.

H = O. D. Hunt.

K = B. Kemp.

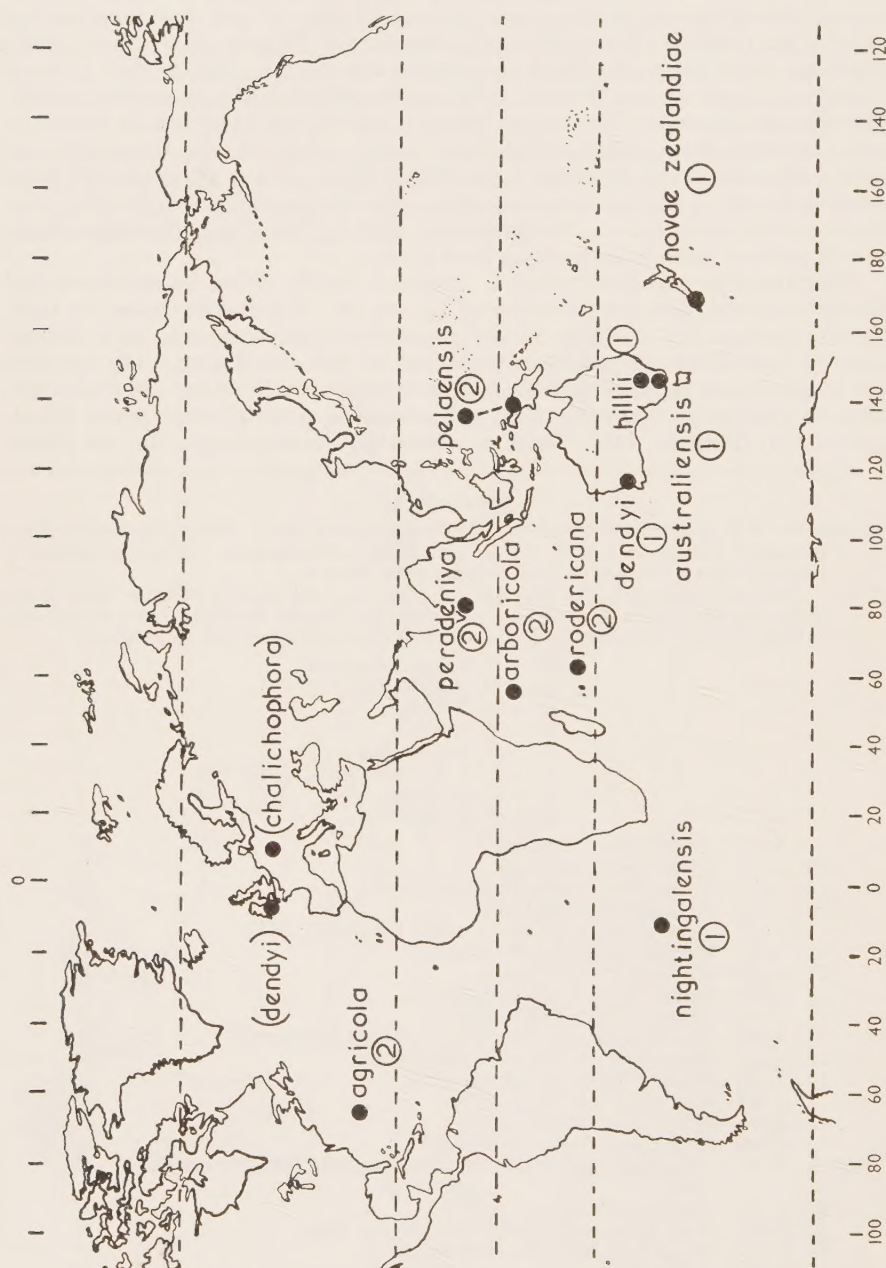
N = A. G. Nicholls.

P = C. F. A. Pantin.

Q = H. E. Quick.

S = B. M. Sparrow.

—	9.35	Clyne Valley, Swansea	<i>Q</i>
19.	3.49	Clyne Valley, Swansea	<i>Q</i>
14.	9.60	Clyne Valley, Cwm Bach, Swansea	<i>P</i>
28.	8.43	R. Yealm Woods, Devon	<i>P</i>
—	10.43	Bromborough Woods, Cheshire (Durham, 1947)	<i>D</i>
21.	5.45	Bromborough Woods, Cheshire	<i>P</i>
27.	9.44	R. Erme Woods, Devon	<i>P</i>
9.	12.44	Caton Wood, Ivybridge, Devon	<i>P</i>
12.	4.44	Shaugh Bridge Wood, Devon	<i>P</i>
9.	3.45	Marine Biological Laboratory Garden, Plymouth	<i>S</i>
28.	4.45	Blaxton Wood, Bere Ferrers, Devon	<i>H</i>
19.	5.45	Pigshill Wood, Maker, Cornwall	<i>S</i>
3.	8.45	Harford in the Moor, Devon	<i>P</i>
16.	8.45	Holne Chase, Dartmoor	<i>P</i>
26.	4.46	Garden at Bangor, N. Wales	<i>B</i>
8.	7.46	Armadales, near Perth, Western Australia (Dakin's original site)	<i>N</i>
20.	7.47	Sneem, Kerry, Eire	<i>K</i>
27.	7.47	West Cove, near Castle Cove, Kerry, Eire	<i>K</i>
11.	12.49	Wood near Beaulieu, New Forest	<i>P</i>
1.	9.57	Woods by Lake Muckcross, Killarney	<i>P</i>
1.	9.57	½ mile E. of Parknasilla, Kerry	<i>P</i>
1.	9.57	8 miles W. of Sneem, Kerry	<i>P</i>
1.	9.57	Kells Bay, Kerry	<i>P</i>
1.	9.57	Cahirsiveen, Kerry	<i>P</i>
30.	8.60	Woods NE. of Trescoe Abbey, Scilly	<i>H</i>
15.	9.60	Wood near Pennal, Machynlleth	<i>P</i>



TEXT-FIG. 2

World distribution of *Geonemertes*. Evident introductions placed in brackets. Numbers indicate mono- or binucleate flame cells.

are liable to form a thin sticky cocoon of tough mucus in which they can withstand drought for a short time. While collecting I have often found them in this state adhering by accident to my hand. They could well be transported during damp weather by migratory birds, such as Redwing, which forage in their natural habitat. One specimen was found in a small garden in the town of Plymouth, separated from open country by at least a mile of dense housing. The distribution in the British Isles suggests that *G. dendyi* is sensitive to cold and to desiccation but can be distributed fairly easily over short distances. Its original importation may be presumed to have occurred at some time with living plants.

The recorded distribution of the species of *Geonemertes* in the world is shown in Text-fig. 2. Apart from the British Isles and European greenhouses, the various species occur on oceanic islands and in Australia and New Zealand. They are not recorded in the literature from the great continents. Whether they are in truth not to be found there is difficult to say. The physiologically analogous land planarians are well known from the continents, and there is no reason why *Geonemertes* should be overlooked. I have made a thorough search for terrestrial nemertines at various points along the eastern seaboard of Brazil without success. Elsewhere I have asked many who go on expeditions to keep a look-out for soft-bodied worms which shoot out a proboscis when stimulated; again without success. But in New Zealand, where they are already known, I have found them (Pl. 4, fig. 1). So far as the evidence goes, apart from introduction, the species are only to be found on oceanic islands, and in Australia and New Zealand.

A further point of importance is that whilst many of the species are found well inland and sometimes, like *Geonemertes dendyi* Dakin and *Geonemertes rodericana* (Gulliver), are known to be killed by sea-water, some of them are definitely littoral. *Geonemertes agricola* (Willemoes-Suhm, 1874) of Bermuda is truly amphibious and is found not only upon hillsides but also between tide marks (Crozier, 1917). Another species, *Geonemertes nightingalensis* Brinkmann, 1947, from the Tristan da Cunha group of islands, occurs above tide marks, but within reach of spray (Pl. 2, fig. 7). In the South Islands of New Zealand, particularly at the Portobello peninsula near Dunedin, I have myself found an undescribed species of a marine hoplonemertine beneath stones, at and above high-tide mark in sheltered bays. In this address I shall call this 'the Portobello nemertine'. It will be named in a succeeding note (Pantin, 1961). It has not merely many of the characters of *Geonemertes* but many of the special characters of the fully terrestrial *Geonemertes novae-zealandiae* and the fully terrestrial Australian species, such as *G. dendyi* (Pl. 1, fig. 6).

The lower part of the zone of distribution is below high-water mark and includes typically marine animals—including other nemertines (Pl. 4, fig. 2). The upper part of its zone is occupied by terrestrial arthropods and even land planarians—though these are killed off at very high tides or in rough weather. It is killed by fresh water, but survives for many hours in sea-water. It survives best in damp air on surfaces thoroughly wet with sea-water.

Quite apart from *Geonemertes*, the region at and just above high-water mark is one of the richest collecting grounds for nemertine worms generally. Stones and rock crevices in the splash zone yield these creatures in all parts of the world I have examined. They occur with a very interesting transitional fauna. In Devon this includes a geophilid centipede, a pseudoscorpion and a variety of transitional gastropods such as *Otina ovata* (Brown). The fauna is in fact remarkably like that of similar crevices in a damp woodland, and reminds us of the probability that this is the route by which more than one group has become terrestrial.

Bearing in mind its widely scattered island distribution and close relation to the sea coast, we must consider how firmly the genus *Geonemertes* really

unites the various species. There is the possibility of convergence. The genus was placed by Bürger (1895) in his family of the Prosorhochmidae of the Metanemertini or Hoplonemertini. All the species possess numerous typical unspecialized hoplonemertine characters, but it cannot be said that in this they resemble Bürger's Prosorhochmidae rather than the other comparatively unspecialized hoplonemertine family, the Tetrastemmatidae. The characters in the lists of Bürger (1895, 1897-1907) and others (Böhmig, 1929) by which these families are separated are few and slight and do not serve to place the species of *Geonemertes* unequivocally in either the one or the other family. The characters listed include such imprecise quantitative features as the relative size of the cephalic mucus gland, the size and position of the cerebral sense organ and of the diverticula of the gut. But the cephalic gland is as large in *Prostoma graecense* (Böhmig, 1898) of the Tetrastemmatidae as in many species of *Geonemertes* (e.g. *Geonemertes chalicophora* Graff, 1879, as described by Böhmig (1898)), and indeed it is said to be absent altogether in *G. hillii* Hett, 1924, though I have in fact found that it is slightly developed in that species. The cerebral sense organ is no smaller in *G. chalicophora* than in *P. graecense*, and the general similarity to the condition in Tetrastemmatidae is noted by Böhmig.

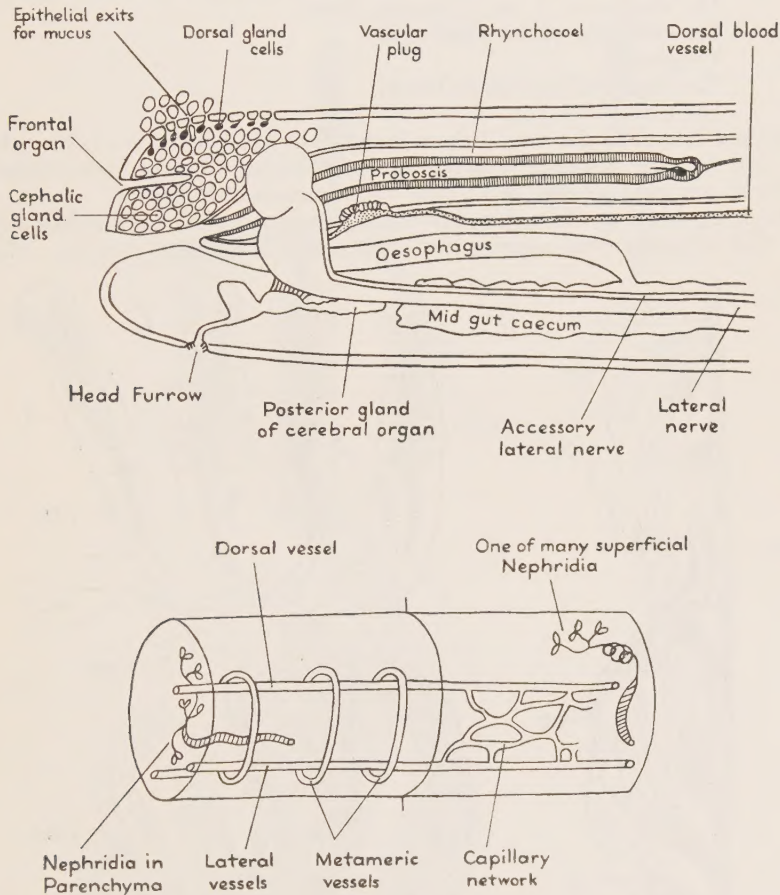
The large forwardly directed pouches from the mid gut caecum of many hoplonemertines are said not to be found in the Tetrastemmatidae:—yet they are as well developed in the Tetrastemmatid *Prostoma graecense* as they are in *G. chalicophora* (Böhmig, 1898) and in *Prosorhochmus* itself (Bürger, 1895, 1897-1907):—whilst in *G. agricola* the mid gut caecum itself extends nearly as far as the brain, giving off many diverticula. One must still agree with Stiasny-Wijnhof (1930) that the time is not yet ripe for revision of the systematic relationships of the simpler families of hoplonemertines. Notwithstanding Bürger's inclusion of the genus *Geonemertes* in the Prosorhochmidae, one is thus free to compare it with any of the genera of both his family and of the Tetrastemmatidae.

The characters of the genus *Geonemertes* have been listed by Hett (1927). Most of these are either generalized hoplonemertine characters (such as the coincidence of the mouth and proboscis opening, or rhynchostome) or qualitative or quantitative particular characters, such as colour or the number of nerves in the proboscis or the number of sacs holding reserve stylets. But such characters are normally quite variable even within a species. A hoplonemertine with longitudinal coloured stripes, two reserve stylet sacs and 12 proboscis nerves might belong to almost any hoplonemertine family. The only distinctive features of *Geonemertes* seem to be:—a reduction in size of the external ciliated furrows on the head, which lead to the cerebral sense organs; the multiplication of the excretory organs or nephridia, though this is shared by some other species, in particular by the freshwater *Prostoma graecense*; and the fact that the animals are terrestrial. These are not strong characters on which to build a genus. There is nothing in the common generic characters to gainsay Brinkmann's (1947) suggestion that the genus is not a natural one, and is a collection of convergent species.

But an assumption of convergence is not to be made lightly: it is the too easy way out of many taxonomic difficulties. The admission of it as a possibility is a very long way from being forced by facts to accept it; though if we are so forced the consequences are of considerable importance both taxonomically and for evolutionary theory. Charles Darwin in 1859 and Alfred Russel Wallace before him in 1855 drew attention to the linear branching character of the natural classification and its significance for the origin of species. Groups we call convergent do not fit a linear branching classificatory scheme. Must we really suppose that this is true of terrestrial nemertines?

Brinkmann has given an interesting review of the relationships of the known

Geonemertes species. He believes that any division of the genus must at present be provisional. This must necessarily be true for the several species which unfortunately are very imperfectly described. But for the rest, his difficulties are perhaps augmented by the rejection of characteristics of the blood system and excretory system. About these, knowledge has certainly been inadequate; yet these systems are easily demonstrated by suitable polychrome stains; and there is special taxonomic value in them. Not only do they add to the total number of points in which the species can be compared, but they concern organs which are peculiarly liable to modification in adaptation to terrestrial conditions. Two terrestrial worms which modify the detail of their excretory organs in just the same way—whilst other terrestrial worms do it differently—are likely to be closely related.



TEXT-FIG. 3

Anatomical scheme illustrating various geonemertine characters.

For a number of the species we have now sufficient evidence to reach conclusions concerning their relationships. By good fortune I have obtained not only specimens of almost all the known species, but in many cases the actual preparations from which these were originally described. From these a number of useful taxonomic characters can be found, which are illustrated diagrammatically in Text-fig. 3.

They include :—

Multiplication of the eyes.

The position and character of the cerebral sense organ.

The position and development of the ciliated head furrow leading to the cerebral organ (Pl. 3, figs 1 and 2).

The presence or absence of an 'accessory lateral nerve' (Pl. 3, figs 5 and 6).

The presence or absence of a frontal organ.

The number and character of the vascular plugs which separate the main blood vessel from the cavity of the rhynchocoele (Pl. 3, figs 3 and 4).

The presence of either metameric vascular loops or of a network of capillaries below the dermal muscular coat.

The character of the excretory ducts.

The character of the flame cells.

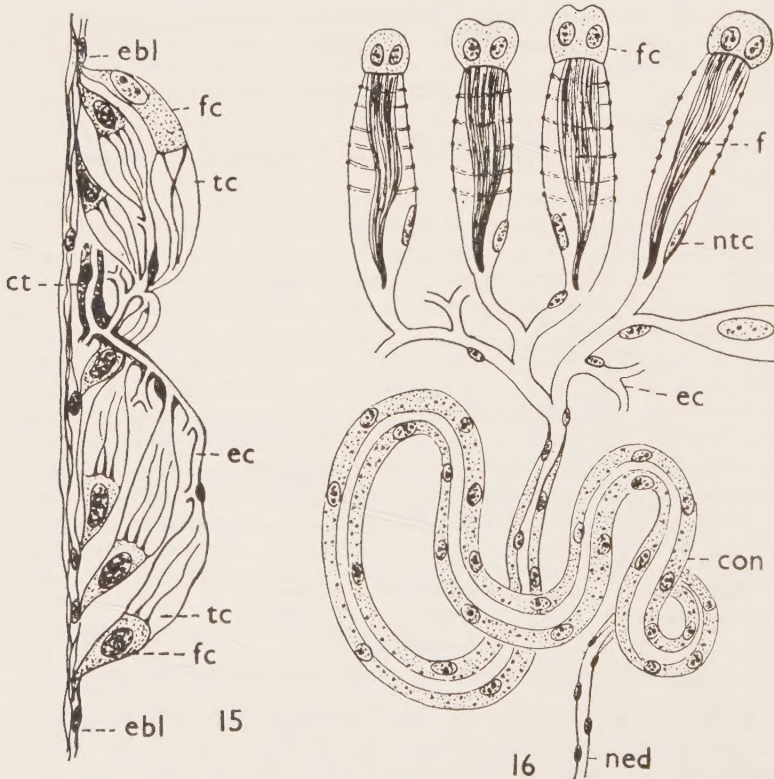
Viviparity.

The degree of terrestrial habit.

The place of origin.

I do not intend to discuss all these in detail in this address :—I only wish to point out that the presence, absence or modification of these quite numerous characters can give a fairly solid basis for taxonomic discussion.

The most striking characters are those concerned with the nephridial system. Old accounts even suggest that this is absent in some species. That is

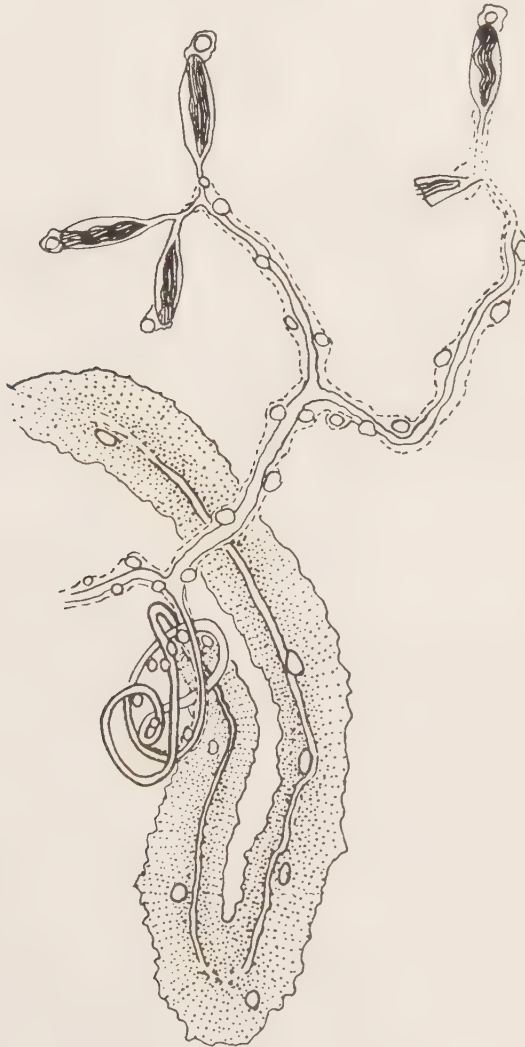


TEXT-FIG. 4

Figure of nephridia of *G. agricola* from Coe, 1930.
(Reproduced by permission of the Editors of *The Biological Bulletin*.)

certainly untrue, as might be expected of terrestrial creatures living in an environment where water-regulation is important. All species possess an excretory system and one which is more highly developed than in any marine species known to me.

Text-fig. 4, from Coe (1930), is of the excretory system of the Bermudan *Geonemertes agricola*. The glandular canal resembles the paired glandular excretory canals of marine Hoplonemertines. But they are broken up and have some hundreds of separate openings to the exterior. On the other hand, the flame cells are remarkable (Coe, 1929, 1930). They are large binucleate structures with rib-like skeletal supports, which with one set of exceptions seem unique in the animal kingdom (Pl. 2, figs 8, 9 and 10).

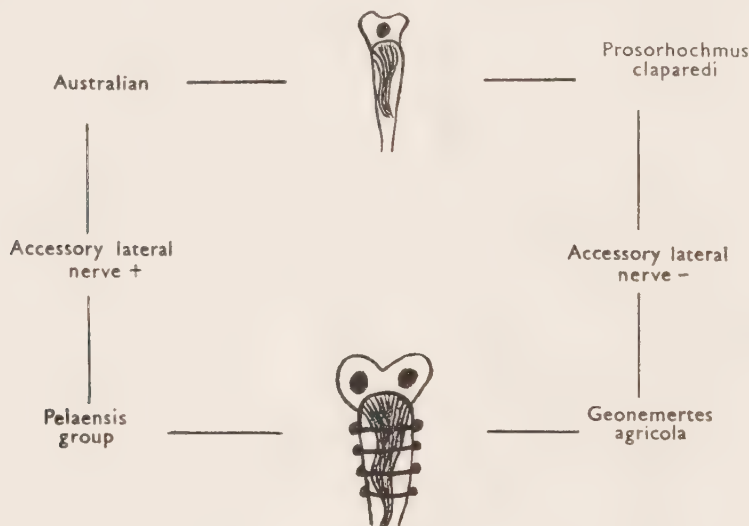


TEXT-FIG. 5

Figure of nephridia of *G. dendyi* from Pantin, 1947.

(Reproduced by permission of the Editors of the *Quarterly Journal of Microscopical Science*.)

In contrast, Text-fig. 5 shows the system for the Australian *Geonemertes dendyi* (Pantin, 1947). The differences are striking. The flame cells here are simple whilst the excretory duct is highly differentiated. The flame cell ducts lead into a convoluted canal which is rich in the enzyme alkaline phosphatase (Danielli & Pantin, 1950); this leads in turn into a glandular tube histologically somewhat different from the main canal of *G. agricola*. There is an interesting convergence with the tubules of the vertebrate kidney. It may be said at once that this type of nephridial duct is shared by the other Australian species, *G. australiensis* Dendy, 1892, and *G. hillii*. It is also shared by the New Zealand species *G. novae-zealandiae* (Pl. 1, fig. 5; Pl. 2, fig. 3) and by no other species.

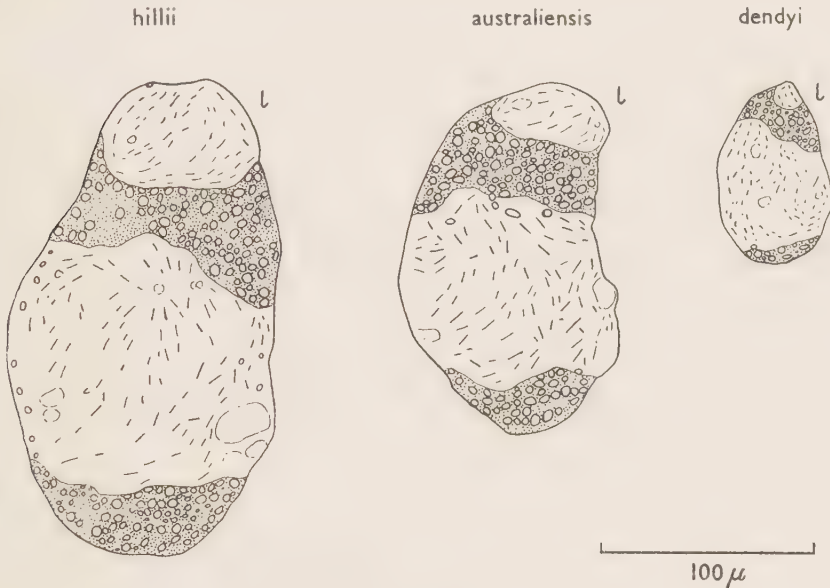


TEXT-FIG. 6
(Description in text.)

The resemblance of the Australian and the New Zealand species is significant. Apart from the excretory systems, they possess in common almost every special character that I have examined except that the New Zealand species retains the primitive condition of only four eyes, against the 20 to 80 of the Australian species. In contrast, *G. agricola* is quite clearly separated from this group of species.

There is a second group of geonemertine species which resemble each other in every major character examined and differ only in coloration and the particular islands which they inhabit. These are Semper's original *Geonemertes pelaensis* (Semper, 1863) from the Pelew Islands, the Celebes and Samoa, described by Coe (1940), Hett (1927) and Schröder (1918); *G. rodericana* (Gulliver, 1879) from Rodriguez; and *G. arboricola* (Punnett, 1907) from the Seychelles. Like the Bermudan *G. aricola*, in all these species the excretory duct resembles that of a generalized hoplonemertine, though it is broken up and has thousands of openings to the exterior, and does not have the elaborate differentiation of the Australian species. But, taking *G. arboricola* as an example, the *pelaensis* group also possesses binucleate flame cells with ribs, somewhat resembling those of *G. agricola* (Coe, 1929, 1930) (compare Pl. 2, figs 5 and 8). That seems to place *G. agricola* and the *pelaensis* group together.

The Australian group differs from the *pelaensis* group in a number of characters, and might be separated from it taxonomically. Unfortunately, in one important feature they resemble each other and differ absolutely from the Bermudan *Geonemertes agricola*. Pl. 3, fig. 5, shows one of Dendy's original sections of *G. australiensis*. It shows one of the lateral nerve chords. It will be seen that the main trunk of nerve fibres has both above and below it a chord of ganglion cells. But further, above the upper ganglionic chord there runs yet another trunk of nerve fibres. This is the accessory lateral nerve. It rises from the dorsal lobe of the cerebral ganglion. Its occurrence is very rare in nemertine species. It seems impossible not to attach considerable functional importance to it. It is a character which is absent from *Geonemertes agricola* (Coe, 1904, 1939) (Pl. 3, fig. 6), but it is possessed by both *G. australiensis* and also by *G. pelaensis*.



TEXT-FIG. 7

Camera lucida drawings of the lateral nerve in three species of Australian *Geonemertes*, just in front of anterior gut diverticula. Note decrease in relative size of accessory lateral nerve *l*, from the largest species *G. hillii* to the smallest *G. dendyi*.

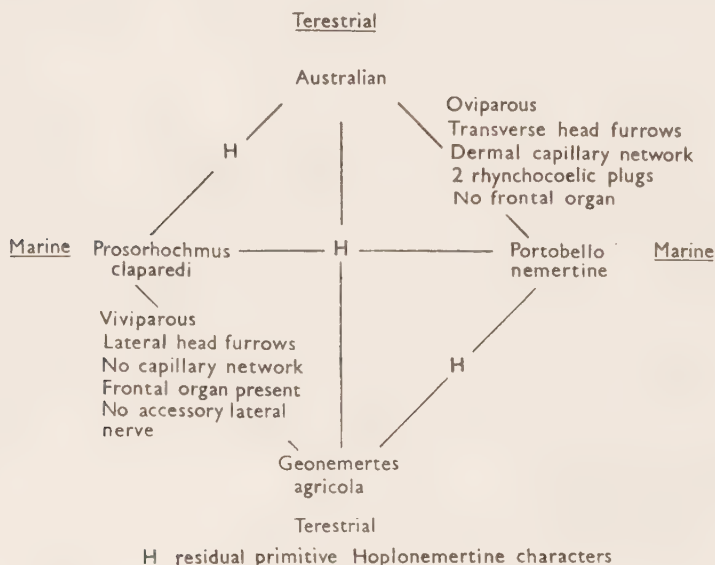
Text-fig. 6 shows the relation of the species with respect to the two characters we have discussed. I have included for comparison the simple hoplonemertine *Prosorhochmus claparedei* of the family to which Bürger also assigned the genus *Geonemertes*. This has simple flame cells and a typically simple excretory canal. In South Devon it is found in crevices from low water up to the splash zone at high-water mark.

Clearly, specialized flame cells and the specialized accessory lateral nerve assort themselves in opposition. Other pairs of clear-cut characters in these and other species also assort themselves in opposition in this way. To arrange the species in a dichotomous classification we must assume that one or other of the pair of characters has been independently evolved or has secondarily reverted to the primitive condition.

Which of the two is most likely to be evolved twice or to have been suppressed? The accessory lateral nerve varies greatly in its development. It is

better developed near the brain than posteriorly. It is better developed in large animals than small; and better in some species than others (Text-fig. 7). Indeed the shore nemertine from Portobello in the South Island has a very small contribution from the dorsal cerebral lobe to the dorsal part of the beginning of the lateral nerve. There is the distinct possibility that the accessory lateral nerve is in fact a much enlarged feature which is more widespread in hoplonemertines than is supposed but which is usually too small to be noticed for taxonomic description.

Likewise the binucleate ribbed flame cells of *G. pelaensis* and *G. agricola* cannot be wholly cleared of the possibility of independent evolution. Even in species with the simple flame cells these usually occur in pairs as in the Portobello nemertine (Pl. 2, fig. 2). In *G. chalicophora*, Böhmig (1898) figures a case of fusion of a pair to make a binucleate double unit. Moreover the arrange-



TEXT-FIG. 8

(Description in text.)

ment of the supporting ribs is not quite the same in *G. agricola* as in the *pelaensis* group (compare Pl. 2, figs 5 and 8). Nor may we forget that at this level of cellular organization molecular limitations favour the independent evolution of similar structures (Pantin, 1951), as in the repeated appearance of striation in muscle among unrelated animals, or in the appearance of nematocysts in the Peridiniales as well as in the Coelenterata (Hovasse, 1951). Such considerations do not prove convergent evolution of the ribbed type of flame cells, but they forbid us to eliminate its possibility.

It is only when a number of characters are taken together that the evidence begins to point unequivocally to convergent evolution. The analysis of the characters of the geonemertine species is as yet far from complete. But as an instance of the evidence, let us consider two marine shore species and their relations to the Australo-New Zealand group and to *Geonemertes agricola*. In Text-fig. 8 the lines marked H indicate that the features common to the species they connect are simply those general to hoplonemertines. But two of the species pairs are much more strongly connected than that. It is difficult to

resist the conclusion that the Australian group comprises terrestrial relatives of the marine Portobello nemertine whilst *G. agricola* may be a terrestrial relative of the marine genus *Prosorhochmus*.

There we must leave the matter for the time being. But if in fact we are brought to consider the possibility of convergent evolution in these species, we may at least consider what is the probability of such a phenomenon. It is here that the fact that *Geonemertes* are characteristically island species becomes important. We know that during the Pleistocene and even since the last 10,000-15,000 years there have been violent fluctuations of both climate and sea level (Godwin, Suggate & Willis, 1958). Emiliani (1955) has brought evidence from oxygen isotope measurements of substantial falls in ocean temperature even in equatorial latitudes during glacial phases. At the recent Royal Society Conference on the Southern Cold Temperate Zone it was clear that where continents and mountain ranges permitted it, species of plants and animals migrated extensively during the cold phases to warmer latitudes. They followed in fact the migration of their climatic optimum. But no such road to safety was open to island faunas, because of their limited size. The destruction of fauna and flora may have been extensive; perhaps as great as it was in the British Isles. With the amelioration of the post-glacial climate, there would be re-colonization. Now marine animals at the very top of the shore in isolated islands are in an almost ideal situation to take advantage of such freedom from terrestrial competitors in possession:—and widely separated islands might become centres for the rapid parallel evolution of new species. On that hypothesis we might usefully look for convergence in island species not only among terrestrial nemertines but among other shore-living transitional groups, such as the gastropods.

At the same time, the distribution of *Geonemertes dendyi* in Britain warns us that under favourable climatic conditions such worms may be distributed by animal or human agency. The occurrence of the very closely related species of the *pelaensis* group, from the Seychelles across the Indian Ocean to the Celebes, puts considerable strain upon any hypothesis of their convergent evolution.

But the greatest puzzle is the occurrence of the peculiar binucleate ribbed flame cells both in the Bermuda species and far away in the Indo-Pacific species. If this be taken to indicate evolutionary relationship we are at once in difficulties. The Bermudan *Geonemertes agricola* seems the most primitive both because it is amphibious, and because of the features it has in common with the simple marine genus *Prosorhochmus*. We must then suppose that the Bermudan species, or some common ancestor in some unknown intermediate site, was carried to the islands of the Indo-Pacific; there to give rise to closely related species all with some new characters convergent with some in the Australian group. That seems to place a considerable burden on the mute and unsung voyages of one or more Vasco da Gamas of the Pleistocene; and we have still failed to escape the assumption of convergent evolution. It is simpler to assume convergent evolution of the ribbed flame cells themselves.

There I shall leave these problems. If we can learn enough geonemertine comparative anatomy we can solve them. But already I think their study shows how much more is to be got out of the taxonomy even of ten or a dozen obscure worms than might be supposed.

Statements and figures in this address about *Geonemertes australiensis* and *G. novae-zelandiae* are based on study of the original preparations of the late Prof. Dendy kindly given to me by the late Prof. Doris Mackinnon, together with examination of specimens of *G. novae-zealandiae* obtained in 1954 from the original site of Dendy's specimens at Toi-toi near Invercargill, New Zealand.

Statements about *G. hillii* are based on study of Miss Hett's (Hett, 1924) specimens. Statements about *G. pelaensis* are based on study of Miss Hett's specimens (Hett, 1927) and those of Dr W. R. Coe (Coe, 1940). Statements about and figures of *G. agricola* are based on specimens kindly collected by Dr Brian Boden in 1951 from Bermuda.

I should like to thank many friends who have helped me to collect and have access to specimens of these worms, particularly Dr August Brinkmann, Dr Brian Boden, Dr Wesley Coe, Miss M. L. Hett, Dr S. Prudhoe, Miss Marion Fyfe, Mr A. L. Southgate and particularly Dr Elizabeth Batham, Director of the Marine Biological Station at Portobello, New Zealand, where some of the material was prepared and photographed.

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DESCRIPTIONS OF PLATES

PLATE 1

FIG. 1.—*Prostoma graecense* from the River Cam (Braithwaite & Clayton, 1945).

FIG. 2.—*Geonemertes dendyi* from Newton Ferrers, South Devon.

(a) Small specimen showing multiple eyes and eggs seen through body wall.

(b) Large specimen.

FIGS 3 and 4.—Eggs of *Geonemertes dendyi*, in capsule, laid about 8 November 1944. Fig. 3, 11 November. Fig. 4, 20 November. First larva escaped 24 November. All escaped by 25 November.

FIG. 5.—Portobello nemertine from above high-tide mark, Portobello. Two specimens, eyes too small to be visible. Note broad dorsal bands. Note lateral edge of band and light belly visible in left-hand specimen.

FIG. 6(a) and (b).—*Geonemertes novae-zealandiae* from Toi-tois, Fortrose, New Zealand. Photographs by Dr E. J. Batham.

PLATE 2

Scale of figs 1 and 4 to 10 given on fig. 5.

FIG. 1.—Horizontal section below muscle layer to show flame cells of *Geonemertes dendyi* (Susa-Mallory).

FIG. 2.—Horizontal section below muscle layer to show flame cells and nephridial ducts of Portobello nemertine. Note adjacent capillary blood vessel.

FIG. 3.—Horizontal sections showing nephridial duct system of *Geonemertes novae-zealandiae*. Note differentiation into coiled and glandular ducts similar to that in *G. dendyi* (Susa-Mallory).

FIG. 4.—Horizontal section below muscle layer to show flame cells of *Geonemertes novae-zealandiae*.

FIGS 5 and 6.—Flame cells of *Geonemertes arboricola* (Iron Haematoxylin). From Seychelles, collection of Professor R. C. Punnett. Structure typical of flame cells of *pelaensis* group of species.

FIG. 7.—Horizontal section showing flame cells and proximal duct of *Geonemertes nightingalensis* (Susa, Masson's Iron Haematoxylin-Orange G.). Specimen from Dr A. Brinkmann.

FIGS 8, 9 and 10.—Flame cells of *Geonemertes agricola* (Iron Haematoxylin). Specimens supplied by Dr Brian Boden.

PLATE 3

FIG. 1.—Slightly oblique transverse section of head of *Proserhochmus clapedei* anterior to brain. Note lateral head furrow on right (arrow). On left, note laterally placed duct (arrow) of right cerebral organ about to enter posterior end of right lateral head a few sections anterior to this.

FIG. 2.—Transverse section of head of Portobello nemertine. Note absence of lateral head grooves; transverse sensory furrow epithelium with right-hand ventrally opening duct (arrow) of cerebral organ showing at edge of furrow in this section.

FIG. 3.—Transverse section of head showing single vascular rhynchocoelic plug (arrow) from dorsal vessel in *Geonemertes pelaensis*. (From slides prepared by W. R. Coe.)

FIG. 4.—Transverse section of head of Portobello nemertine showing pair of vascular rhynchocoelic plugs (arrows) arising from anterior right and left branches of dorsal vessel (as in Australian-type geonemertines).

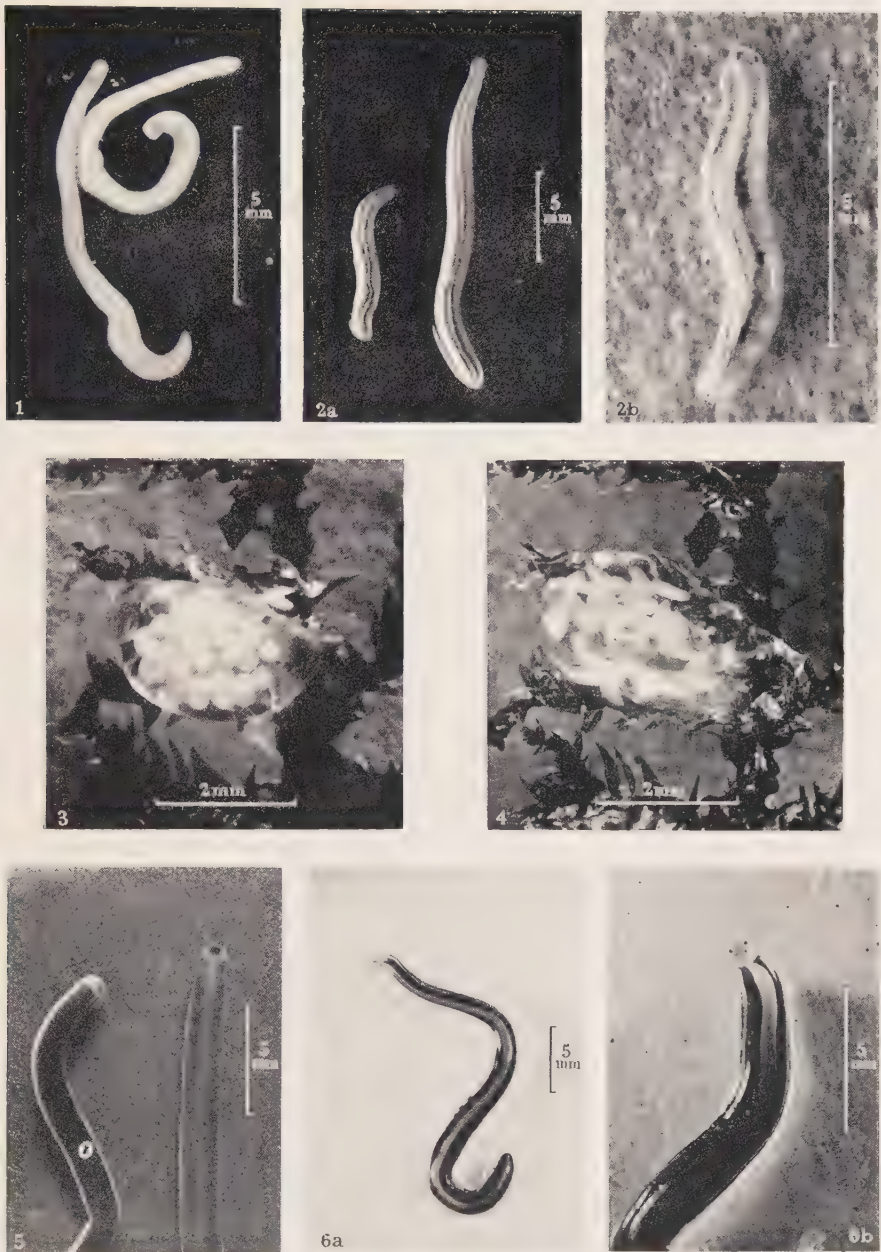
FIG. 5.—Transverse section of *Geonemertes australiensis* from Professor Dendy's collection, showing accessory lateral nerve (arrow).

FIG. 6.—Transverse section of *Geonemertes agricola* (collected by Dr Brian Boden) showing absence of accessory lateral nerve (arrow).

PLATE 4

FIG. 1.—Grove at Toi-tois, Fortrose, New Zealand (photographed in 1954). The type locality of *Geonemertes novae-zealandiae* Dendy.

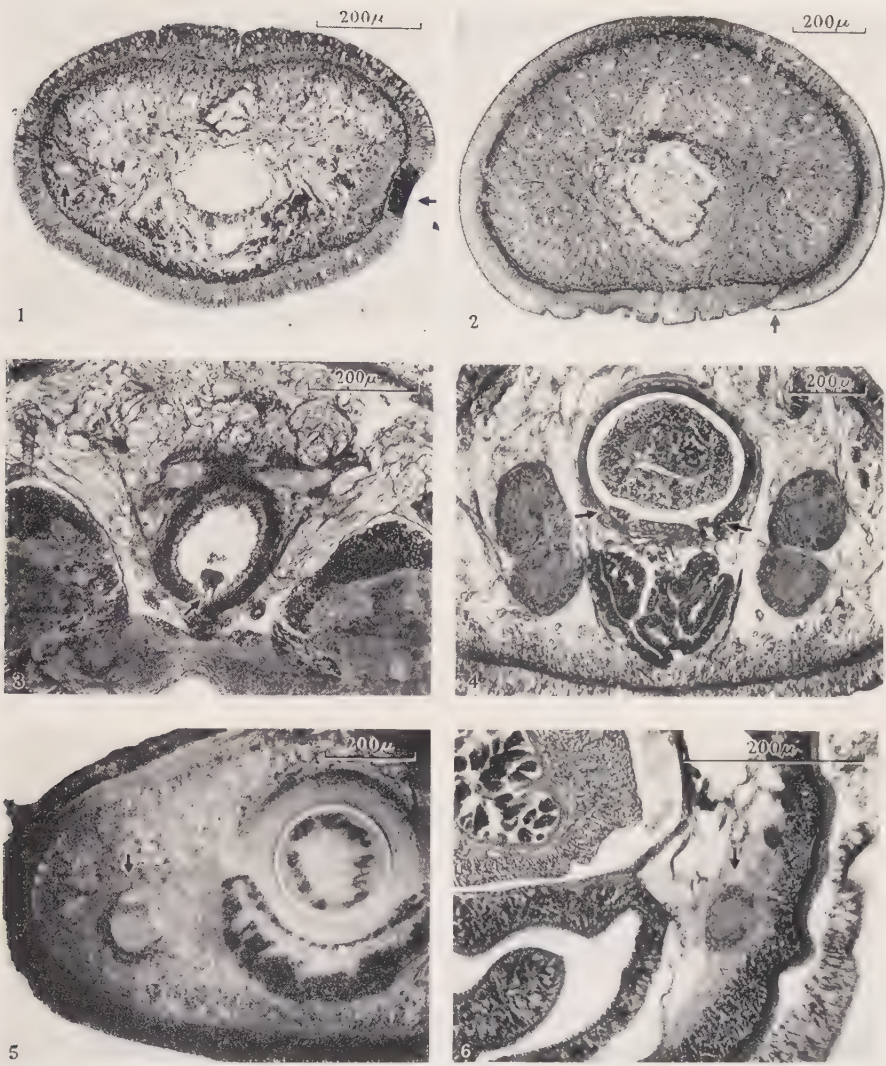
FIG. 2.—Collecting site of Portobello nemertine, shore at Crib Beach, Portobello. Note Log (with white saucer on top):—worms abundant. White brick to right:—upper limit of high-water spring tides. Lower white brick further to right:—lower limit of abundant worms.



Description of plate on page 152.



Description of plate on page 152.



Description of plate on page 152.



Description of plate on page 162.

ACTEONEMERTES BATHAMAE, GEN. ET SP. NOV.
AN UPPER LITTORAL NEMERTINE FROM PORTOBELLO,
NEW ZEALAND

By C. F. A. PANTIN, F.R.S. Pres. L.S.

(With 1 Plate)

SUMMARY

AN upper littoral nemertine from Portobello, New Zealand, shows relationships with certain *Geonemertes* species, but it is differentiated from them. A new genus *Acteonemertes* is made for the reception of the species which is given the name of *Acteonemertes bathamae*.

The nemertine from Portobello, near Dunedin, New Zealand, discussed in the previous paper (Pantin, 1961) shows relationships to some *Geonemertes* species, but it is clearly differentiated from them. I therefore find it necessary to erect a new genus, *Acteonemertes*, for the reception of the species, and I would name it *Acteonemertes bathamae* in compliment to the Director of the Marine Biological Station at Portobello in New Zealand.

Acteonemertes nov. gen.

The sole included species belongs to the family Prosorhochmidae as characterized by Bürger in various places (Bürger, 1895 : 553 ; 1897-1907 : 427 ; 1904 : 29). The characteristics ascribed by Bürger to the family, and even to the genera comprised therein, are taxonomically very weak—often they are no more than characters common to most simple Hoplonemertines. I agree with Stiasny-Wijnhoff (1930) that the families of the simpler Hoplonemertines need revision but we need more anatomical knowledge before this can be done. Pending this revision, and any further investigation of the present new species and its relationships to other forms, I shall follow Bürger in his characterizations of the family and its three comprised genera : *Geonemertes* C. Semper, *Prosorhochmus* Kef. and *Prosadenoporus* Bürg.

The species agrees with Bürger's Prosorhochmidae having the eyes arranged at the four corners of a rectangle with the long axis across the body (the eyes in the new species are small) ; gut pouches and genital sacs regularly alternate ; cerebral organs small and anterior ; head (mucus) glands strongly developed. There about 15 proboscis nerves, a number which falls within the range of the species comprised in the family. The rhynchocoel extends the whole length of the body. All the large specimens are ripe females. Small specimens (30-40 mm.) examined proved to be males. Sperm are illustrated in Pl. 1, fig. 1.

The large females are full of eggs about 0.7 mm. in diameter. Dr Batham has found egg masses associated with females. Though we have not seen the egg masses discharged, the eggs develop into young nemertines about 2 mm. long, with four eyes. A batch of eggs collected 24. xi. 60 hatched 31. xii. 60. As in several species of *Geonemertes*, small males may be found with females. The sexes are either separate or the animal is a protandrous hermaphrodite.

The characteristics of the new species from Portobello are now compared with those of each of the three genera as given by Bürger :—

Prosadenoporus (Bürger, 1890 : 8, 29 ; 1895 : 555 ; 1897-1904 : 428 ; 1904 : 31).

Bürger's characteristics are that the animals are marine, possess neurochords and are probably oviparous. He also notes the presence of a frontal organ (Kopfgrube) in all the four species he describes in the genus.

The Portobello species is oviparous but it possesses no frontal organ. Mucus escapes by adventitious channels through the dermis on the head, as in the Australian *Geonemertes* species. Though there are some large ganglion cells, none have the very large size of neurochord cells. Certainly I have not seen so far any evidence of enormous neurochord cells such as Bürger (1895) figures for *Prosadenoporus*.

Prosorhochmus (Keferstein, 1862 : 55 ; Bürger, 1892 : 552 ; 1897–1907 : 428 ; 1904 : 29).

Unlike the Portobello nemertine, *Prosorhochmus* is viviparous and possesses lateral head-furrows. The head furrow into which the ducts of the cerebral organs open is transverse in the Portobello nemertine as mentioned and figured in the previous paper (Pantin, 1961).

Unlike the Portobello nemertine *Prosorhochmus* has no network of capillary vessels below the dermal musculature.

Unlike it again, *Prosorhochmus* has a frontal organ.

Geonemertes (Semper, 1863 : 559 ; Bürger, 1895 : 553 ; 1897–1907 : 429 ; 1904 : 32).

Though differing in various characters from some species of *Geonemertes* the Portobello nemertine shows a strong resemblance to the Australian group of species as described in my Presidential Address (Pantin, 1961). It is oviparous. There is a transverse head-furrow. There is a subdermal capillary network. There are two vascular plugs, arising from the right and left anterior branches of the dorsal blood vessel, protruding into the rhynchocoel (see Pl. 3, fig. 4 of Pantin, 1961). There is no frontal organ. These parallels seem significant. The relation to other species of *Geonemertes* is discussed in my Address (Pantin, 1961).

In behaviour, the Portobello nemertine resembles the Australian *Geonemertes dendyi*. The proboscis is quite readily everted, and when exposed to dry conditions it burrows into the earth.

However, despite its transitional habitat, the Portobello nemertine differs from *Geonemertes* in that it is still fundamentally marine and not terrestrial. Moreover, unlike the Australian *Geonemertes* species, it possesses no accessory lateral nerve—though a small contribution from the dorsal ganglion is made to the lateral nerve (Pl. 1, fig. 2). The Portobello nemertine possesses a subdermal flame cell system of simple flame cells very similar to that of the Australian *Geonemertes* (see Pl. 2, fig. 2 of Pantin, 1961). The nephridia, however, lack the striking differentiation into coiled duct and glandular duct seen in the Australian species.

The type of *Acteonemertes* is the species (*Acteonemertes bathamae*) described immediately below.

***Acteonemertes bathamae* n. sp.**

The only included species in the new genus, *Acteonemertes* Pantin, erected above. The species possesses the characteristics mentioned in discussing the relationship of the new genus to the other genera of the family Prosorhochmidae.

Size and Appearance in Life

Three to eight centimetres in length and 2–3 mm. in diameter (see Pl. 1, figs 3 and 4). Two dorsal, very broad, dark chocolate brown, bands separated

by a narrow pale line on the dorsal surface. The ventral surface is pale. The head is pale but darker on the forehead. There are four small simple eyes, of which the posterior pair is very small and may be doubled as in Pl. 1, fig. 3. Other details have been given in my Presidential Address (Pantin, 1961).

Locality

Common under large stones in splash zone between high water marks of spring and neap tides. In sheltered bays on the Portobello Peninsula, near Dunedin, South Island, New Zealand.

Original collections from Crib Beach, Portobello Peninsula, 10.x.54 to 21.xi.54. I have been informed by New Zealand zoologists that it is to be found elsewhere (places unspecified) in the South Island and has been found in similar situations on Stewart Island.

Material, Types, etc.

The species has been described and the genus diagnosed from numerous specimens taken at Portobello, New Zealand. Live specimens were photographed at the time of collection.

Many specimens were fixed (using Susa fixative and other methods) and sectioned. Of these preserved specimens, six (taken on 26.xi.54) have been specially investigated. Three specimens, designated *A*, *B* and *C*, have been fully sectioned by me and examined anatomically.

Of these three specimens *B* is hereby designated the Holotype (in life it was about 5 cm. long and 2-3 mm. in breadth). All these six specimens are at present in my possession as three whole specimens in liquid paraffin and as three sets of sections.

I also have some six other specimens collected at the same time which, though fixed, are broken in pieces; and I have other specimens recently supplied by Dr Batham from Portobello.

I wish to thank the Editor, Dr John Smart, for his great help both in the preparation of this note and in many valuable discussions concerning the taxonomic relationships of these nemertines.

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 — 1930. Die Gattung *Oerstedtia*. *Zool. Meded.*, **13** : 226-240, 3 pls, 1 fig.
 — 1937. *Prostoma eilhardi* (Montgomery), eine holländische süßwasser-nemertine. *Arch. Neerland.*, **3** : 165-178, 12 figs.

PLATE 1

Acteonemertes bathamae

FIG. 1.—Fresh sperm from a small male.

FIG. 2.—Transverse section through posterior part of brain showing a small dorsal ganglionic contribution to the ventral ganglion (at arrow).

FIG. 3.—Susa-fixed male, cleared in methyl benzoate, to show position of eyes. The sperm in fig. 1 were obtained from the hind end of this specimen.

FIG. 4.—Living *Acteonemertes bathamae*.



Description of plate on page 156.

RECORD OF THE PROCEEDINGS OF THE SOCIETY FOR THE SESSION 1959-60

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3. Extraordinary Meetings of the Society, Symposia organized by the Society's Specialist Groups, etc.	161

1. THE GENERAL MEETINGS OF THE SOCIETY

15 October 1959.—The first Meeting of the Society for the Session—Professor C. F. A. Pantin, F.R.S., President, in the Chair.

The Proceedings of the Anniversary Meeting held on 28 May and the Additional Meeting held on 23 July 1959, were taken as read and confirmed.

The following signed the Obligation in the Roll and Charter Book and were admitted Fellows :—John Frederick Spilsbury, B.Sc. ; Dr Hermann-Heino Heine ; Simpson Miller Gault ; John MacLaren Waterston, B.Sc., Ph.D. ; Reynold Mark Ridgway, B. Pharm. ; Geoffrey Hill Abraham, M.Sc. ; Kathleen Isabel Margaret Chesters, B.Sc., Ph. D. and Agnes Beryl Beakbane, B.Sc., Ph. D.

The following communications were made :—

Dr C. R. Metcalfe, Sec. L.S.—A Botanical Visit to the West Indies. (Illustrated with colour transparencies.)

Dr Norman K. B. Robson, F.L.S.—*Iter Zambesiicum* 1958-59. (Illustrated with colour transparencies.)

5 November 1959.—Professor C. F. A. Pantin, F.R.S., President, in the Chair.

The Proceedings of the General Meeting held on 15 October 1959 were taken as read and confirmed.

The following signed the Obligation in the Roll and Charter Book and were admitted Fellows :—Peter A. Screen, B.Sc. ; Ioan Foster Thomas, M.A. and David Wilkie, B.Sc., Ph.D.

The following communication was made :—

Dr John Morton (Visitor).—The Molluscan Pattern. Evolutionary Trends in the Phylum and a criticism of Present Classification.

(Discussed by the President, Dr Anna Bidder and Dr D. T. Donovan ; Dr Morton replied.)

19 November 1959.—Mr A. W. Exell, Vice-President, in the Chair.

The Proceedings of the General Meeting held on 5 November 1959 were taken as read and confirmed.

Dennis Percival Stanfield signed the Obligation in the Roll and Charter Book and was admitted a Fellow.

Candidates for membership were balloted for and duly elected :—*Fellows* : John Ronald Beynon Arthur ; E. C. Bate-Smith, M.Sc., Ph.D. ; Professor Thomas Archibald Bennet-Clark, M.A., Ph.D., F.R.S. ; Robert Bernard Benson, M.A. ; Michael Brandon-Bravo, B.Sc. ; Ronald Stewart Byles ; Geoffrey Tremain Creber, B.Sc. ; Gordon M. L. Haskell, B.Sc., Ph.D. ; John Greenland Hughes, B.Sc., Ph.D. ; Peter Francis Hunt, B.Sc. ; Eric Cartwright Jones, B.Sc. ; Dr André J. G. H. Kostermans ; Harold Edward Leslie Mellersh, B.Sc. ; Bernard John Rendle, B.Sc. and Frank Derek Sprague Richardson, M.A.
Ordinary Associate : Stephen Hurry, B.A.

The following communications were made :—

Dr E. A. Schelpe, F.L.S.—Problems in the Biology of Extra-tropical Pteridophytes (with special reference to South African Ferns). (Illustrated with colour transparencies.)

(Discussed by Prof. I. Manton, Mr A. W. Exell, Prof. R. S. Adamson, Dr R. Melville, Dr H. Hamshaw Thomas and Dr R. E. Holttum ; Dr Schelpe replied.)

Dr R. E. Holttum, F.L.S.—Some Thoughts on the Present State of Fern-taxonomy, with Special Reference to British Species.

(Discussed by Prof. I. Manton, Mr A. C. Jermy, Dr E. A. Schelpe and Mr R. Ross ; Dr Holttum replied.)

28 January 1960.—Professor C. F. A. Pantin, F.R.S., President, in the Chair.

The Proceedings of the General Meeting held on 19 November 1959 were taken as read and confirmed.

The following signed the Obligation in the Roll and Charter Book and were admitted Fellows :—Ronald Stewart Byles ; Frank Derek Sprague Richardson, M.A. ; Norman Willison Simmonds, M.A. and Peter F. Hunt, B.Sc.

The following communications were made :—

Mr Wm. T. Stearn, F.L.S.—How Many Species of Flowering Plants have Taxonomists yet to Describe ?

(Discussed by Dr C. G. Ainsworth, Dr J. Ramsbottom, Miss M. A. Brooke and Mr P. R. Bell ; Mr Stearn replied.)

Dr W. S. Lacey, F.L.S.—A Botanical Visit to Central and South Africa. (Illustrated with colour transparencies.)

11 February 1960.—Professor C. F. A. Pantin, F.R.S., President, in the Chair.

The proceedings of the General Meeting held on 28 January 1960 were taken as read, amended, and confirmed.

Geoffrey Tremain Creber, B.Sc. signed the Obligation in the Roll and Charter Book and was admitted a Fellow.

The following communications were made :—

Professor C. F. A. Pantin, F.R.S., Pres. L. S.—Alfred Russel Wallace and His pre-Darwinian Essay.

(Discussed by Mr Wm. T. Stearn ; the President replied.) Published in *Proc.*, **171** : 139–154 (1960).

Mr Quentin Bone.—The Origin of Chordates.

(A discussion on this communication was opened by Dr G. S. Carter followed by Dr M. Whitear, Dr Philip Whiting, Prof. E. J. W. Barrington, Mr L. B. Tarlow and the President ; Mr Bone replied.) The paper and the contributions to the discussion have been published in *J. Linn. Soc., (Zool.)*, **44** : 252–269 (1960).

25 February 1960.—Professor C. F. A. Pantin, F.R.S., President, in the Chair.

The proceedings of the General Meeting held on 11 February 1960 were taken as read and confirmed.

Ian J. Linn, B.Sc. signed the Obligation in the Roll and Charter Book and was admitted a Fellow.

The following communications were made :—

Dr G. Kuschel (Visitor).—The Natural History of the Juan Fernandez Islands. (Illustrated with colour transparencies.)

Dr M. W. Holdgate (Visitor).—The Natural History of the South Chilean Island. (Illustrated with colour transparencies.)

17 March 1960.—Professor C. F. A. Pantin, F.R.S., President, in the Chair.

The proceedings of the General Meeting held on 25 February 1960 were taken as read and confirmed.

The following signed the Obligation in the Roll and Charter Book and were admitted Fellows :—E. C. Bate-Smith, M.Sc., Ph.D. ; Bernard John Rendle, B.Sc. and Michael Brandon-Bravo, B.Sc.

The following communications were made :—

Dr V. H. Heywood, F.L.S.—Progress in the *Flora Europaea* Project.

(Discussed by the President and Mr E. M. Marsden-Jones ; Dr Heywood replied.)

Mr Eric M. Marsden-Jones, F.L.S.—The Life Cycle of *Adleria kollari* Hartig (Cynipidae).

(Discussed by the President and Mr E. Milne-Redhead ; Mr Marsden-Jones replied.)

21 April 1960.—Professor C. F. A. Pantin, F.R.S., President, in the Chair.

The proceedings of the General Meeting held on 17 March 1960 were taken as read and confirmed.

The President reported that the following reply had been received from the Private Secretary to Her Majesty the Queen in response to the Loyal Congratulatory Message sent on the occasion of the birth of Prince Andrew :—

‘... I am commanded by Her Majesty to ask you to convey to your President her sincere thanks and those of The Duke of Edinburgh for the kind congratulations which he has sent on behalf of the Society on the occasion of the birth of The Prince Andrew.’

The President reported that the Council had nominated Dr H. Hamshaw Thomas, M.B.E., F.R.S., and Dr Libbie H. Hyman for the award of Linnean Gold Medals for 1960, and Dr L. E. R. Picken for the Trail Award and Medal.

Eric Cartwright Jones, B.Sc. signed the Obligation in the Roll and Charter Book and was admitted a Fellow.

Candidates for membership were balloted for and duly elected :—*Fellows* : Peter René Oscar Bally ; Mrs Barbara Barrard, B.Sc. ; Prof. Oliver Meredith Boone Bulman, Sc.D., Ph.D., F.R.S. ; Miss Susan Carter, M.Sc. ; Alan John Crosby-Browne, M.A. ; Richard Sidney Richmond Fitter ; Brian William Fox, B.Sc., Ph.D. The Hon. Robert Gathorne-Hardy, B.A. ; Miss Sheila Spenser Hooper, B.Sc. ; Anthony Clive Jermy, B.Sc. ; Stuart Stanley Kind, B.Sc. ; Srinivasan Krishnaswamy, M.Sc., Ph.D. ; Edward Raymond Lewis, M.Sc. ; Lord Medway, M.A. ; Kharaiti Lal Mehra, M.Sc. ; Miss Beryl Mary Courtenay Morgan, B.A. ; John Kenneth Morton, B.Sc., Ph.D. ; Jafar Nizam ; The Rev. Ian Ronald Phelps, B.Sc. Ph.D. ; Michael William Service ; Henry Neville Southern, M.A. ; Ronald Duncan Tweed ; Leslie Watson, B.Sc. ; Mary McCallum Webster and John James Yealland. *Ordinary Associates* : Miss Anne Evelyn Scrivener, B.Sc. and William Alfred Stevens, B.Sc.

The following were elected Auditors of the Treasurer's Accounts for 1959-60 under Chap. 10. Sec. 7 of the Bye-Laws :—*For the Council*—Mr J. P. M. Brenan, Mr. H. L. G. Stroyan. *For the Fellows*—Mr R. Ross, Dr E. Trewavas.

The following communications centred on *Productivity of the Sea* were made :—

Mr Ronald Currie (Visitor).—Solar Radiation and Nutrients in Primary Production.

Dr D. H. Cushing (Visitor).—On the Part Played by Grazing in the Productive Cycle in the Sea.

Dr G. E. Fogg (Visitor).—Dissolved Organic Substances and Phytoplankton Production.

(Discussed by the President, Professor V. J. Chapman, Dr J. P. Harding and Mr R. Ross ; Mr Currie, Dr Cushing and Dr Fogg replied.)

5 May 1960.—Professor C. F. A. Pantin, F.R.S., President, in the Chair.

The Proceedings of the General Meeting held on 21 April 1960 were taken as read and confirmed.

The following signed the Obligation in the Roll and Charter Book and were admitted Fellows :—Miss Beryl Mary Courtenay Morgan, B.A. ; Miss Mary McCallum Webster ; Kharaiti Lal Mehra, M.Sc., Ph.D. ; Mrs Barbara Barrard, B.Sc. ; Leslie Watson, B.Sc. ; Miss Susan Carter, M.Sc. and Miss Sheila Spenser Hooper, B.Sc.

The following communications were made :—

Mr H. R. Hewer, O.B.E., Sec. L.S.—Expedition to North Rona, October 1959. (Illustrated by a colour film and slides.)

Mr N. W. Simmonds, F.L.S.—Useful and Ornamental : a Miscellany of Tropical Plants. (Illustrated with colour transparencies.)

2. THE ANNIVERSARY MEETING OF THE SOCIETY ON 24 May 1960

Professor C. F. A. Pantin, F.R.S., President, in the Chair.

The following signed the Obligation in the Roll and Charter Book, and were admitted Fellows :—Anthony Clive Jermy, B.Sc. ; Brian William Fox, B.Sc., Ph.D. ; Gordon M. L. Haskell, B.Sc., Ph.D. ; Prof. Oliver Meredith Boone Bulman, Sc.D., Ph.D., F.R.S. and John James Yealland.

Candidates for membership were balloted for and duly elected :—*Fellows* : John Leggett Bailey, Ph.D. ; David James Bellamy, B.Sc. ; John Charles Blackater ; Gordon Parker De Wolf, Jr, M.Sc., Ph.D. ; Desmond Thomas Donovan, B.Sc., Ph.D. ; Phyllis Irene Edwards, B.Sc. ; Alvaro Fernández-Pérez, D.Pharm. ; Hedley John Gooding, B.Sc. ; Martin Wyatt Holdgate, M.A., Ph.D. ; Kamleshwar Kashyapa, M.Sc. ; Grenville Llewellyn Lucas, B.Sc. ; Mohanlal Bhanabhai Patel, B.Sc., B.Pharm. ; Thomas Richard Edmund Southwood, B.Sc., Ph.D. *Foreign Members* : Prof. Dr Cornelius Gijsbert Gerrit Jan van Steenis and Dr. Robert Evans Snodgrass. *Associates honoris causa* : Harold Frederick Cober ; Denys A. Kempson ; Prof. Dr Alexander Eric Kohts. *Ordinary Associate* : David Thomas Streeter, B.Sc.

The President declared the Ballot for New Members of Council to be open and voting began.

The Ballot was closed at the due time and the result declared to the Meeting. *Elected* :—Dr Arthur James Cain ; Prof. Arthur Roy Clapham, F.R.S. ; Dr William Peter Crowcroft ; Mr Frederick Claude Deighton, O.B.E. ; Mr John Francis Levy.

The retiring Councillors were :—Prof. L. J. Audus, Mr A. W. Exell, Dr J. P. Harding, Dr Doris M. Kermack and Mr R. D. Meikle.

The President presented one of the Society's Gold Medals to Dr Libbie Henrietta Hyman mentioning the pleasure that it gave him to be handing it to her in person ; the President's citation is printed in full on p. 162.

The President then handed the second of the Society's Gold Medals to Dr Hugh Hamshaw Thomas, M.B.E., F.R.S., one-time President of the Society ; the President's citation is printed in full on p. 163.

The President then gave the Trail Medal and Award to Dr Laurence Ernest Royland Picken ; the President's citation is printed in full on p. 164.

The Financial Report was given by the Treasurer and the Accounts of the Society, duly audited, for the year 1959–60 were laid before the meeting. (See pp. 165 and 171.)

On the motion of Mr P. R. Bell, seconded by Dr Wm. T. Stearn, the accounts were adopted.

The General Secretary presented his Report. (See p. 167.)

The President declared the Ballot for Officers to be open and voting began.

The Annual Review of the Society's activities was read by the President. (The Review is printed in full on pp. 169-170.)

The President then delivered his Address on '*Geonemertes*: A Study in Island Life'. On its conclusion, Dr A. Tindell Hopwood moved, 'That the President be thanked for his excellent address, and that he be requested to allow it to be printed and circulated amongst the Fellows.' The motion was seconded by Prof. J. Omer-Cooper and being put to the Meeting was carried with acclamation. (Published, *Proc.*, **172**: 137-152.)

The result of the Ballot for Officers was declared to the Meeting:—*President*: Professor Carl Frederick Abel Pantin, F.R.S.; *Treasurer*: The Rt Hon. The Earl of Cranbrook, C.B.E.; *Botanical Secretary*: Dr Charles Russell Metcalfe; *Zoological Secretary*: Dr Henry Gwynne Vevers, M.B.E.; *Editorial Secretary*: Dr John Smart.

The President announced that he would appoint the following as Vice-Presidents for the Session 1960-61:—Mr. E. J. H. Corner, F.R.S.; The Earl of Cranbrook, C.B.E.; Mr H. R. Hewer, O.B.E. and Dr W. G. Templemann.

The President declared the business of the Anniversary meeting completed and declared the Session ended.

3. EXTRAORDINARY MEETINGS OF THE SOCIETY, SYMPOSIA ORGANIZED BY THE SOCIETY'S SPECIALIST GROUPS, ETC.

3 December 1959.—The President's Reception was held in the Society's Rooms at 8.30 p.m.; the guests were received by Professor and Mrs C. F. A. Pantin, F.R.S.

A film '*The Hippopotamus Problem in Uganda, 1958*' by Mr Oliver Hook and Mr H. N. Southern was shown in the Meeting Room; Mr Southern gave a commentary.

The following contributed exhibits:—

Mr N. INGRAM HENDEY, F.L.S. and Dr H. G. STUBBINGS, F.L.S., Admiralty Materials Laboratory, Poole, Dorset.—Biology in the Service of the Royal Navy. Dr S. M. MANTON, F.R.S., F.L.S.—Working models of certain Arthropod legs showing their basic movements, joints, musculature and specializations. Dr ANNE J. ALEXANDER, Zoological Laboratory, Cambridge.—Aspects of Scorpion biology. Dr F. R. PARRINGTON, Zoological Laboratory, Cambridge.—A skull of the cynodont reptile *Trirachodon kannemeyeri* Seeley. Mr F. N. HEPPER, F.L.S., Royal Botanic Gardens, Kew.—Climbing plants. Mr P. TAYLOR, F.L.S., Royal Botanic Gardens, Kew.—Distribution and synonymy of *Utricularia gibba*. Professor D. G. PETERS, Dr N. G. M. HAGUE and Mr A. M. OMIÐVAR, Imperial College, London.—Population studies on potato root eelworm and its host. Mr T. C. WHITMORE, Botany School, Cambridge.—The bark of tropical trees. Mr CHEW WEE LEK, Botany School, Cambridge.—Urticaceae and Moraceae: *Poikilospermum*, the intermediate. Dr C. R. METCALFE, Sec. L.S., Royal Botanic Gardens, Kew.—Histology of grass leaves as a tool in the classification of the Gramineae. Mr WM. T. STEARN, F.L.S., British Museum (Natural History).—Design of Herbarium labels and Aaron Aaronsohn's Wild Palastinian Wheat (shown by Miss Rifka Aaronsohn). Mr R. D. MEIKLE, F.L.S. and Mr L. L. FORMAN, F.L.S., Royal Botanic Gardens, Kew.—Living plants from the Royal Botanic Gardens, Kew.—THE ZOOLOGICAL SOCIETY OF LONDON.—Exhibition of living land invertebrates from the Tropics. Dr S. M. WALTERS, F.L.S., Botany School, Cambridge.—Fragments of the Darwin-Babington Correspondence. THE NATURE CONSERVANCY (Dr J. E. Satchell, Grange-over-Sands).—(a) Colour Polymorphism in an Earthworm. (b) Resistance in Oak to damage by *Tortrix viridana*. Dr A. V. GRIMSTONE, Zoological Laboratory, Cambridge.—Electron micro-

graphs of the complex flagellate, *Trichonympha*. Mr P. R. O. BALLY, Royal Botanic Gardens, Kew.—Rare and unusual Succulents from Tropical East Africa. Dr W. E. CHINA, British Museum (Natural History).—The Antarctic Distribution of Insects. Mr PETER JAMES, British Museum (Natural History).—Distribution of species of the Genus *Neuropogan*. Mr E. W. GROVES, British Museum (Natural History).—Two recent collections made in Scandinavian Lapland. Dr S. M. WALTERS, F.L.S., Botany School, Cambridge.—Darwin's Galapagos plants. An Album of Photographs illustrating the character and activities of the Museum Darwinianum, Moscow. (Presented by the Director, Prof. Alexander Kohts.) A picture of Charles Darwin formerly belonging to Ivan Michurin (loaned by Professor N. A. Nikiforov).

The Library was decorated with plants from the Royal Botanic Gardens, Kew, and the Rooms with cut flowers sent by the Treasurer.

4 March 1960.—A symposium on 'The Subspecies': being a joint meeting arranged by the Society and the Systematics Association.

Chairman :—Professor D. H. Valentine.

The following were the speakers and the titles of their papers :—

Prof. D. H. Valentine, F.L.S.—Introduction. Dr J. G. Hawkes, F.L.S.—Subspecies in Flowering Plants. Dr E. F. Warburg, F.L.S.—Subspecies in Bryophytes. Mr R. Ross, F.L.S.—Subspecies in Algae, especially Diatoms. Dr I. C. J. Galbraith.—Subspecies in Birds. Dr Theresa Clay.—Subspecies in the Mallophaga of Birds.

Mr H. L. G. Stroyan, F.L.S. and Dr G. P. De Wolf, F.L.S. opened the Discussion.

8 January 1960.—A symposium on 'The Reproductive Phase in Seed Plants' arranged by the Society's Experimental Plant Morphology Group. (The papers read have been collected and published in *Proc.*, **172** (1) : 90–127.)

Chairmen :—Mr A. W. Exell, V.-P. L.S. and Dr C. R. Metcalfe, Sec. L.S.

The following were the speakers and the titles of their papers :—

Professor C. W. Wardlaw, F.L.S.—The inception of the inflorescence. Dr E. G. Cutter.—Floral morphogenesis in the Nymphaeaceae. Professor J. P. Hudson, Dr I. H. Williams and Miss J. M. Cook.—Effects of environment and age on flowering in raspberries. Professor J. Heslop Harrison, F.L.S.—The control of sex expression in some grasses of the Maydeae. Dr K. A. Longman.—Factors affecting flower initiation in certain conifers. Mr P. R. Bell, F.L.S. opened the Discussion.

11 July 1960.—A meeting of the Plant Anatomy group of the Society under the Chairmanship of Dr C. R. Metcalfe, Sec. L.S.

Professor Vernon I. Cheadle gave an address on 'The Secondary Phloem in Dicotyledons'.

A discussion followed.

9 September 1960.—An additional meeting of the Society was held under the Chairmanship of Mr H. R. Hewer, O.B.E., Vice-President.

Dr G. W. Reynolds was admitted a Fellow of the Society.

Dr G. W. Reynolds addressed the Society on 'Botanical Travels in Ethiopia, Somaliland and Madagascar'. (Illustrated with colour transparencies.)

A discussion followed.

THE PRESIDENT'S CITATIONS ON PRESENTING THE LINNEAN GOLD MEDALS FOR 1960 AND THE TRAIL AWARD AND MEDAL

DR LIBBIE HENRIETTA HYMAN

The Gold Medal of the Society, in Zoology, is awarded to Dr Libbie Henrietta Hyman. From the early days of her work on the physiology of Amoeba she

quickly passed to a study of the physiology of Turbellarian worms. But soon her main interest centred upon the comparative anatomy and taxonomy of these animals. During the last 40 years she has become the world authority on them. Yet she never confined her interest to the anatomical and taxonomic study of any single group: nor did she cease to add to our knowledge of the physiology and mode of life of invertebrate animals. Zoologists know well her admirable laboratory manual of comparative vertebrate anatomy. Her work on the taxonomy of the Hydras and on the feeding and mode of digestion in Medusae shows the range of her investigations.

All Dr Hyman's work has been characterized by accuracy and insight; but until 1940 few realized the immense scope of her learning. We remember with pleasure how during the darker days of the last war there appeared the first volume of her great treatise on zoology. From that volume, *Protozoa through Ctenophora*, she has passed on to review the flatworms, nematodes, echinoderms, hemichordates and many other simple coelomate groups. She has in prospect the Mollusca, the Annelida and, she hopes, the Arthropoda; a grand synoptic survey of the invertebrate animal kingdom in eight volumes; a survey known to every zoologist for its high quality and its balanced judgments. It is the special virtue of this work that it is no mere organized compilation. It includes essays on the evolution, taxonomy and anatomical principles of the animal kingdom which are lasting contributions to science in their own right, and to which every serious student may direct himself with profit.

It is easy to find a parallel to what she has done, but to find it in one place alone. Boswell, in his life of Dr Samuel Johnson, said:

'The Dictionary, with a grammar and history of the English Language, being now published, the world contemplated with wonder so stupendous a work achieved by one man, while other countries had thought such undertakings fit only for whole academies.'

What Boswell there says of Dr Johnson's great Dictionary, we can today say quite truly of Dr Hyman's textbook of the invertebrate animal kingdom. Whole academies in more than one country have attempted to do what she has done. The debt of every zoologist to her is immense.

Dr Hyman, it is a particular pleasure that you are here in person to receive this award. By the authority and in the name of the Linnean Society of London I give you this token of our gratitude for your work.

DR HUGH HAMSHAW THOMAS

The Gold Medal of the Society in Botany is awarded to Dr Hugh Hamshaw Thomas. In this room, particularly, Dr Thomas needs no introduction. He was elected a Fellow of the Society in 1925 and, ever since, has served us and the scientific objects for which the Society stands. The value of his work on our Council and the great distinction with which he held the office of President, particularly during the important year of the celebrations of the bicentenary of the birth of Linnaeus, are fresh in our minds.

But it is not our gratitude for this which we mark in this occasion. The medal we award today is in recognition of his very long career as palaeobotanist of world-wide reputation. Over 50 years ago, when Curator of the Botany Museum in the University of Cambridge, he began to publish papers on the vegetation of Gothland, on the assimilatory tissues in Coal-Measure plants, on palaeobotanical techniques, and the Jurassic flora. This work laid the foundation of his reputation. With uncanny insight into what would prove to be important, he made the Mesozoic Floras his domain. He unearthed the Caytoniales and the Corystospermaceae. With his great knowledge of plant

structure he showed how these unsuspected fossils challenged the accepted views on the evolution of the flower. Thus he launched the New Morphology, as a fact, undisturbed by preconception. The combination of novelty, insight and absolute respect for the observed phenomena had its reward in the immense stimulus given to the students who have been guided by him.

It is characteristic of the best kind of synthetic mind that the intellectual advances which they give us make use of every sort of human experience. Though a palaeontologist, Dr Hamshaw Thomas has never forgone the active study of the living flora in all parts of the world; in Canada, the West Indies and in South Africa. Moreover, insight into natural phenomena must rest upon ability to perceive why, in any generation, we happen to view and to interpret nature in the way we do. It is just this which has led Dr Thomas to those illuminating studies in the history and philosophy of science, and to establish this as a discipline in Universities.

But further, the interruption of two world wars was turned to advantage by the philosopher. Let those who believe this kind of biology too academic for a serious place in the modern world bear in mind how much during the last war we owed to the interpretation of aerial photographs, not by some specialist of the physical sciences but by a distinguished palaeobotanist who saw at once the relation of this problem of our survival to principles of taxonomy and comparative anatomy.

But these things do not over-shadow what biologists hold to be the primary gift; that is the ability to discover and interpret the objects of nature. It is not given to many to know how to find absolutely new sorts of organisms or to explain them with fearless honesty. The flow of palaeobotanical literature from his pen has revealed in him this gift, and the presentation of this medal is the Society's mark of respect for his pre-eminence.

Dr Hamshaw Thomas, by the authority and in the name of the Linnean Society of London I give you this token of our gratitude for your work.

DR LAURENCE ERNEST ROWLAND PICKEN

The Trail Award and Medal is given 'To encourage study that throws light on the substance known as protoplasm, on the physical basis of life'. On this occasion it is given to Dr Laurence Ernest Rowland Picken. From the time of his early work on the salt exchange in invertebrate animals he has been especially interested in protozoa and in the fine structure of protoplasmic systems. He has been particularly successful in demonstrating the relation of molecular structure to the shape of living membranes, of cells and of tissues. He has shown how gross structure may be determined in this way by molecular structure, as in the beautifully organized bristles and hairs which cover the surface of the fly *Drosophila* and the scales of Lepidoptera. Among his contributions is a highly successful analysis of the molecular organization of the so-called stinging cells—the coelenterate nematocysts, which are the most complex of natural secretions. Their structure goes far to explain their very remarkable mode of discharge. Perhaps his greatest work is now in the press. It is a textbook entitled *The Organization of Cells and Other Organisms*. It covers the whole range of the fine structure of cells and their components, and of simpler organisms down to the viruses. It is exhaustive and novel in its approach, and in the opinion of those who have already had the privilege of reading it, its appearance may well prove to be a landmark in the history of cellular biology.

Dr Picken, by the authority and in the name of the Linnean Society of London I give you this award and medal in token of our admiration for your work.

TREASURER'S REPORT 1959-60

The printed copies of the Accounts now before you cover the year ended 31 March 1960. The comparison figures for last year are on the left. A Statement has been prepared by the Auditors, who certify as to details, the Audit Committee has inspected the books, verified the investments and Bank Balances and passed the accounts; the action of the Committee has been confirmed by the Council.

Herewith a brief account of the main items:—

On the Receipt Side

Annual Contributions are a little above last year's due to a slight net increase in Fellowship. The limit to the number elected is 1000, the present number is 895. A Fellowship nearer the limit would be of substantial assistance to the Society's finances.

Composition Fees are much lower than last year (the £124 shown and £144 balance from last year has been invested).

Interest and Dividends are much higher due to more money being on deposit in the various accounts, recovery of income tax on some of last year's dividends and a small increase in dividends on new investments made last year.

Sales of Publications.—The figure is less than last year's record figure which included receipts from the sale of the joint Botanical and Zoological Darwin-Wallace Centenary Journal. This year's figure includes the sales of the *Proceedings* of the XVth International Congress of Zoology, the stock of which was very generously given to the Society by the Congress.

Grants for Publications.—We are greatly indebted to the Council of the Royal Society for the grant of £600 from the Parliamentary Grant-in-aid towards the cost of the Society's publications and to Imperial Chemical Industries Ltd, the Imperial Forestry Institute, Oxford, and Mr I. H. Burkill for grants towards costs of illustrations in papers printed by the Society.

Sale of Investments.—I will give details of this later.

Income Tax on Deeds of Covenant.—I am happy to say that our outstanding claims for 1955-56 to 1958-59 have been paid. Of the total of £1517, all less the amount of £263 due in the current year, has been invested. A number of Fellows pay their Annual Contributions under Deed of Covenant which is of substantial benefit to the Society, and it is hoped that as many Fellows as possible will undertake to pay their Annual Contributions in this way.

Transfer from Reserve Funds.—The General Account has received the balance of the reserve set aside to meet the cost of the Darwin-Wallace Centenary celebrations.

On the Payment Side

Electricity, Gas and Fuel.—A little below last year's figure due to the milder winter.

Repairs and Renewals.—Much less than in recent years as we have not had to undertake any major redecoration.

Miscellaneous Printing and Stationery and Dispatch.—A slight rise above last year's figure.

Miscellaneous Expenses and Postages.—A substantial increase above last year's figure due to the President's Reception (£112) which was not held last year, and a £40 duplicate payment of the telephone Account which will be recovered this year.

Publications.—The figure is much less than last year but does not include

much of the cost of publications in hand, the printing and distribution of which has been delayed because of the printing strike last year.

Salaries, Wages and Pensions are about the same as last session.

Purchase of Investments.—These include the income tax recovered on Deeds of Covenant for the first three of the four years received, Composition Fees and redemption of £1000 Defence Bonds.

Library Fund.—We are very grateful to the Council of the Royal Society for their grant of £1000 for binding and repairs of library books and to the John Innes Institute for their Annual Gift of £10.

Library Restoration Fund.—Again this year only a small amount has been received, and it is hoped that Fellows and friends will continue to give this Fund all the support they can by gifts and legacies.

The balance of £1846 is earmarked for expenditure on repairs to Linnaeus' Library, the purchase of metal cases for his manuscripts and for the purchase of arrears of foreign periodicals.

Fellows' Postal Account is self-explanatory. It is of great assistance if regular borrowers from the library could send a deposit rather than wait to be asked to refund postage with every parcel sent.

THE TRUST AND RESERVE FUNDS

There are two items to which I would like to draw your special attention :—the £250 received from Imperial Chemical Industries in response to an appeal for funds for the maintenance of the Society's Library and the anonymous donation of £1107 received for the rehabilitation of the Linnaean Collections.

It is expected that the *Berberis* paper will be published this session and the reserve of £1000 will be expended.

The Statement of the Photographic Recording of the Linnaean Herbarium show that the Society has so far received £168 from the sales of the microfiches. On the first 100 copies sold the Society will receive £1200 of which £600 is to be refunded to the Nuffield Foundation. We understand that to date some 43 copies have been ordered.

INVESTMENTS

There have again been changes in the investments held by the Society as is explained below under the various accounts. Fellows should note that a little over half the value of the investments held on the General Account and nearly three-quarters of those on the Library Account are in 'equities'. These now stand at values which give a yield some 2 per cent less than that which would be obtainable if they were sold and the proceeds re-invested in 'gilt-edged', but taking a long view it seems wiser to leave them where they are and hope for further capital appreciation and increased dividends.

In the *General Account* the Pension (Equities) Units, the Charterhouse Group and Eagle Star Insurance were purchased. Rights issues in the Lonsdale Investment Trust, Peninsular Investment Co. and Barclays Bank taken up with the proceeds of the redemption of £1000 Defence Bonds, shown in last year's List of Investments, and new money in the shape of £268 Composition Fees and £1254 income tax recovered on Deeds of Covenant 1955–58. These last two therefore account for £1522 of the increase in value of £3339, the remaining £1800-odd being due to bonus issues of Barclays Bank and Lonsdale Investment Trust, and to the net increase in the market value of the investments held. In fact, taken as a whole, the gilt-edged have fallen slightly, the rise in the equities having more than counterbalanced that fall.

Library Account

No new investments have been purchased but bonus issues of Glasgow Stockholders Trust and Lonsdale Investment Trust have been received. The market value has increased by approximately £1500, the increase being proportionately greater than in the General Account since the Library account had proportionately more invested in equities than had the General Account.

Special Accounts

We have received the Mrs Jane Jackson bequest, the income from which has to be used to increase the remuneration of the staff. Excluding that bequest, the market value of the gilt-edged securities has fallen by approximately £80. The only other change is the automatic re-investment of the income of the Staff Pension Fund.

The Accounts, as at present drawn up, are in fact a cash account, merely showing money received and money expended and e.g. a comparison between the balances at the beginning and end of the year does not necessarily give a true picture of the state of the Society's finances. Cash may have been received for the sale of a publication before the bill for printing has been paid, when the balance will be unduly large and vice versa the bill may have been paid before any sales have been effected etc., etc.

Acting upon the advice of the Professional Auditors the Council has agreed that future Annual Accounts will, in addition to a statement of receipts and payments, give an indication of the amount of monies due to and by the Society at the end of the Financial year.

In conclusion I should like to thank our General Secretary, Mr T. O'Grady and our Clerk, Mrs E. Ziegler to whom is due the admirable way in which the Accounts of the Society are kept.

GENERAL SECRETARY'S REPORT 1959-60

List of the Society

Since the last Anniversary Meeting the Society has lost 23 members. The detailed statement is as follows :—

12 Fellows by death :

Gerald Mortimer ASH.	Henry Rissik MARSHALL.
Agnes ARBER.	Frederick Albert MITCHELL-HEDGES.
Sidney BLAKE.	Jack ROBERTS.
Richard Charles L'Estrange BURGESS.	Edward Percy STEBBINGS.
Robert P. CELARIER.	Allan UGGLA.
William Ernest DICK.	Henry Newcome WRIGHT.

2 Associates honoris causa by death :

Douglas Miller REID.	Walter WATSON.
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2 Foreign Members by death :

William Marius DOCTERS VAN LEEUWEN.	Alfredo RAMALHO.
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7 Fellows by Withdrawal :

Frederick William ANDREWS.	June Rosemary LAWTON.
Archibald Park BALFOUR.	Lady Sybil STERN.
Joseph Maskrey FISHER.	Ellen Mary STEPHENSON.
Basil Hubert HARLEY.	

During the Session 53 Fellows, 2 Foreign Members, 3 Associates *honoris causa* and 4 Ordinary Associates have been elected. The number of Fellows on the List is 875 with a further 20 Fellows elected but still to qualify; Foreign Members 50, Associates *honoris causa* 25 and Ordinary Associates 19; 4 ordinary Associateships have expired during the year of which 2 have been elected Fellows.

Fellows Elected

John Ronald Beynon ARTHUR.
John Leggett BAILEY, Ph.D.
Peter René Oscar BALLY.
Mrs. Barbara BARRARD, B.Sc.
E. C. BATE-SMITH, M.Sc., Ph.D.
David James BELLAMY, B.Sc.
Prof. Thomas Archibald BENNET-
CLARK, M.A., Ph.D., F.R.S.
Robert Bernard BENSON, M.A.
John Charles BLACKATER.
Michael BRANDON-BRAVO, B.Sc.
Prof. Oliver Meredith Boone BUL-
MAN, Sc.D., Ph.D., F.R.S.
Ronald Stewart BYLES.
Miss Susan CARTER, M.Sc.
Geoffrey Tremain CREBER, B.Sc.
Alan John CROSBY-BROWNE, M.A.
Gordon Parker DE WOLF, Jr, M.Sc.,
Ph.D.
Desmond Thomas DONOVAN, B.Sc.,
Ph.D.
Phyllis Irene EDWARDS, B.Sc.
Alvaro FERNÁNDEZ-PÉREZ, D.
Pharm.
Richard Sidney Richmond FITTER.
Brian William FOX, B.Sc., Ph.D.
The Hon. Robert GATHORNE-HARDY,
B.A.
Hedley John GOODING, B.Sc.
Gordon M. L. HASKELL, B.Sc., Ph.D.
Martin Wyatt HOLDGATE, M.A., Ph.D.
Miss Sheila Spenser HOOPER, B.Sc.
John Greenland HUGHES, B.Sc., Ph.D.

Peter Francis HUNT, B.Sc.
Anthony Clive JERMY, B.Sc.
Eric Cartwright JONES, B.Sc.
Kamleshwar KASHYAPA, M.Sc.
Stuart Stanley KIND, B.Sc.
Dr André J. G. H. KOSTERMANS.
Srinivasan KRISHNASWAMY, M.Sc.,
Ph.D.
Edward Raymond LEWIS, M.Sc.
Grenville Llewellyn LUCAS, B.Sc.
Lord MEDWAY, M.A.
Kharaiti Lal MEHRA, M.Sc.
Harold Edward Leslie MELLERSH,
B.Sc.
Miss Beryl Mary Courtenay MORGAN,
B.A.
John Kenneth MORTON, B.Sc., Ph.D.
Jafar NIZAM.
Mohanlal Bhanabhai PATEL, B.Sc.,
B.Pharm.
The Revd. Ian Ronald PHELPS,
B.Sc., Ph.D.
Bernard John RENDLE, B.Sc.
Frank Derek Sprague RICHARDSON,
M.A.
Michael William SERVICE.
Henry Neville SOUTHERN, M.A.
Thomas Richard Edmund SOUTH-
WOOD, B.Sc., Ph.D.
Ronald Duncan TWEED.
Leslie WATSON, B.Sc.
Mary McCallum WEBSTER.
John James YEALLAND.

Foreign Members Elected

Prof. Dr Cornelius Gijsbert Gerrit Jan VAN STEENIS.
Dr Robert Evans SNODGRASS.

Associates honoris causa Elected

Harold Frederick COMBER. Prof. Dr Alexander Eric KOHTS.
Denys A. KEMPSON.

Ordinary Associates Elected

Stephen HURRY, B.A. William Alfred STEVENS, B.Sc.
Miss Anne Evelyn SCRIVENER, B.Sc. David Thomas STREETER, B.Sc.

The Library

Between 1 May 1959 and 30 April 1960 44 books have been purchased ; 60 books, 145 parts of periodical publications and 177 reprints have been presented. During the same period the number of volumes bound was 938, 168 volumes were repaired and rebound ; the number of volumes borrowed was 708 and 801 signatures were recorded in the Library Visitor's book.

Many meetings of other Societies continue to be held in the Society's Rooms.

THE PRESIDENT'S ANNUAL REVIEW

After two successive years of intense activity in celebration of the birth of Linnaeus and of the famous communication to us by Charles Darwin and Alfred Russel Wallace, the year just ended has been more normal. We have held 13 meetings, including three symposia, a joint meeting with the Systematics Association and the Presidential Reception.

The papers presented at the General Meetings have included many of exceptional scientific interest. Among those contributed by visitors I would remind the Society of the admirable discussion of the evolution and classification of the Mollusca given by Dr John Morton just before his return to New Zealand to take up his Chair, and of the interesting account by Dr Kuschel, of the University of Chile, of the natural history of the Juan Fernandez Islands. During the summer recess a special meeting was held at which members of the staff of the Imperial College of Tropical Agriculture in Trinidad, led by Dr G. A. C. Herklots, addressed the Society. (See *Proc.*, **171** : 164.)

Symposia have now become one of the most valuable features of our sessions. We are most grateful to all those who took part in the two-day discussion of quarternary ecology last December ; the all-day discussion on the reproductive phases of seed plants last January ; and the discussion on the subspecies held in March.

The thanks of the Society are again due to the many Fellows and visitors who provided such interesting exhibits at the Presidential Reception ; and particularly to the Director of the Royal Botanic Gardens at Kew for the floral decorations and to the Zoological Society for their exhibition of living land invertebrates. I never attend these functions without being impressed by the singular beauty of our Library and our apartments, and with the earnest hope that we and our kindred Societies shall never be evicted from Burlington House. There is perhaps something symbolical in the fact that we and the Geological Society stand between the Societies of the courtyard and all Piccadilly.

Our buildings are fine and old ; and fine old buildings present us with problems. Minor repairs to our water supply are apt to remind us that the plumbing of 100 years ago may be overtaken by modern requirements, and the necessary renovations require finance. But the most serious problem remains with our Library. As I said last year, Council made a thorough analysis of the position. To do what is wanted money is needed and Council intend soon to issue an appeal for funds. It is a pleasure already to report a donation of £250 towards this end from Imperial Chemical Industries.

Last year I referred to a generous loan by the Nuffield Foundation of £600 to finance the photographic reproduction of the Linnaean Herbarium. I am pleased to say that the venture has proved a great success. We have received enthusiastic letters about the quality of the reproduction and we are already in sight of repaying the loan.

On financial matters, in October we received a splendid anonymous gift of £1107.

I should like to express our gratitude to the XVth International Zoological Congress, from whom we received for the financial benefit of the Society the remaining stock of its Proceedings and of the admirable reprint of the early essays of Darwin and Wallace on Evolution by Natural Selection. In this connection I should like to record our great appreciation to our constant friend Sir Gavin de Beer, the President of the Congress, for his untiring efforts on our behalf.

I referred last year to the re-organization by Council of our system of publication. We now have an editorial Committee and Dr John Smart is our Editorial Secretary. Already the *Journal of Botany* is now being published to a regular timetable and it is intended that the *Journal of Zoology* will soon also follow a timetable, and the *Proceedings* in which the papers contributed to Symposia will be published. I am pleased to say that the system is working well and there is a flow of contributions of good quality. Unfortunately, like all other Journals, our publication was seriously impeded by the Printers' Strike last year, but our new organization stood this test well and we now have every prospect of publishing as punctually as other efficient Journals.

During the year death has removed many from our Fellowship. I would, however, recall two names especially of those who are gone. Douglas M. Reid during his life in London played a most active part in our Society on the Council and as Vice-President in 1942-43. He was also Secretary of the Crustacea Committee in 1949, an activity which ultimately led to the publication of the valuable Synopses of the British Fauna. Many will remember him in retirement in his pleasant and hospitable home at Stoer. In Dr Agnes Arber, F.R.S., we have lost one of the really great Botanists and one to be remembered far outside that science by her book *The Mind and the Eye*.

It seems inevitable that with the increasing success of our Society there is more administrative work for your Council. We have had much difficult business and we have done much. As President I look with gratitude to our Treasurer and to our Secretaries and our Council. But I am very sure you will join me in expressing our most sincere appreciation of the work of our retiring Zoological Secretary, Mr Humphrey R. Hewer. By our self-denying ordinance we do not re-elect a secretary for a period of more than six years' service. It is no coincidence that the increasingly flourishing state of our Society coincides with his tenure of office: and we had a splendid experimental control of the value of his service when we saw the felicitous manner in which he organized the International Zoological Congress. We regret his departure from office. We are grateful for all he has done in organizing our programmes, our symposia and in re-organizing our administration. Perhaps the key to his success is the fact that he combines administrative ability with the refreshing and independent interest in the world of the true naturalist: he knows so clearly what the Society is about. Only at the previous meeting he gave us an account of his work on the natural history of the Seals of Rona, a fine study of 'Natural History in all its branches'.

I will close by once again giving honour where above all honour is due. To our General Secretary, Mr O'Grady, and to the other members of our staff I extend the thanks of our whole Society. Without their tireless help and goodwill our efforts to maintain our science would come to nothing.

ACCOUNTS FOR THE YEAR ENDED 31 MARCH 1960

Receipts and Payments of the Linnean Society

General

1958-59		RECEIPTS	£	s.	d.	1959-60	
£			£	s.	d.	£	s. d.
		To Balance at 1 April 1959 :—					
		Current Account at Bank.....	225	10	9		
		Deposit Account at Bank.....	609	11	0		
		Deposit Account Post Office Saving Bank....	26	7	4		
		Cash in hand.....	35	8	5		
		Capital Cash with Stockbroker.....	13	6	11		
854						910	4 5
80		„ Admission Fees				108	0 0
		„ Arrears of Annual Contributions.....	151	11	11		
		„ Annual Contributions Current.....	3435	17	3		
		„ „ „ in advance	83	3	6		
3646						3670	12 8
8		„ Annual Contributions of Associates.....				8	18 10
235		„ Composition Fees				124	0 0
		„ Dividends on Investments and Deposit Account					
		Interest.....	617	2	3		
—		„ Income Tax recovered	112	4	0		
500						729	6 3
2		„ Interest on Post Office Saving Bank Account.....				2	1 6
		„ Sales of Publications :—*					
		Transactions	100	10	5		
		Journals	1756	17	10		
3137		Proceedings, etc.....	1012	19	1		
		„ Grants in aid of Publications :—				2870	7 4
1000		Royal Society.....	600	0	0		
—		Imperial Chemical Industries Ltd.....	115	0	0		
—		Imperial Forestry Institute, Oxford.....	60	0	0		
—		Mr. I. H. Burkill.....	35	0	0		
500		Dr. Hugh Scott.....	—	—	—		
						810	0 0
36		„ Donations				—	—
199		„ Miscellaneous Receipts.....				125	16 1
500		„ Transfer from Reserve for Publications Fund.....				—	—
2898		„ Proceeds of redemption of 4½% Defence Bonds.....				1000	0 0
—		„ Income Tax recovered on Deeds of Covenant (4 years to 5 April					
		1959)				1517	15 2
—		„ Darwin Wallace Celebrations, 1958					
		Transfer from Special Accounts.....				114	10 9
13595						£11991	13 0

* Not including Publications sent on Exchange : estimated cost price £620.

Library

£		£	s.	d.	£	s.	d.
212		To Balance at 1 April 1959.....	688	11	0		
		„ Interest on Investments.....	201	10	11		
		„ Income Tax recovered	13	15	0		
119					215	5	11
10		„ Donations : John Innes Horticultural Institution.....	10	0	0		
50		Ray Society	—	—	—		
21		Imperial Chemical Industries Ltd.....	—	—	—		
500		„ Transfer from General Account.....	500	0	0		
650		„ Royal Society Grant—Binding and Repairs.....	1000	0	0		
2880		„ Sale of Surplus Library Books.....	—	—	—		
4442			£2413	16	11		

Library

£		£	s.	d.
1833		To Balance at 1 April 1959.....	1838	18 3
5		„ Donations : Fellows	7	2 0

1838		£1846	0 3
------	--	-------	-----

Fellows' Postal

£		£	s.	d.
29		To Balance at 1 April 1959.....	36	17 0
10		„ Deposits	2	0
39			£36	19 0

(Presented at the Anniversary Meeting, 24 May 1960)

from 1 April 1959 to 31 March 1960

Account

1958-59			1959-60		
£	PAYMENTS	£ s. d.	£	s.	d.
299	By Electricity, Gas and Fuel.....		281	18	8
428	„ Repairs and Renewals.....		85	5	9
47	„ Fire Insurance.....		46	10	0
374	„ Miscellaneous Printing and Stationery and Dispatch.....		401	13	5
480	„ Miscellaneous Expenses and Postages.....		622	17	0
	„ Publications :—				
	Printing.....	2844 19 10			
	Distribution.....	129 0 3			
	Illustrations.....	741 5 5			
5041			3715	5	6
500	„ Transfer to Library Account.....		500	0	0
2359	„ Salaries, Wages and Pensions.....		2352	0	2
60	„ National Insurance.....		60	9	0
58	„ Staff Annuities (Annual Premium).....		58	0	0
15	„ Donations : Zoological Record.....	15 0 0			
	International Union for Nature Pro-				
	tection.....	2 2 0			
2	Council for Nature.....	1 0 0			
—			18	2	0
4	„ <i>International Assoc. for Plant Taxonomy—Subscription</i>		42	10	0
42	„ Linnean Medals.....				
	„ Purchase of Investments (Including £268 1s. 3d. Investment of				
2976	Compounders' Fees).....		2522	0	4
	„ Balance at 31 March 1960 :—				
	Current Account at Bank.....	497 6 8			
	Deposit Account at Bank.....	727 15 4			
	Deposit Account Post Office Savings Bank.....	28 8 10			
	Cash in hand.....	31 10 4			
910			1285	1	2

13595

£11991 13 0

Account

£		£ s. d.
307	By Periodicals*.....	295 5 7
280	„ Binding.....	877 17 0
189	„ Books.....	127 5 2
2977	„ <i>Purchase of Investments</i>	
689	„ Balance at 31 March 1960.....	1113 9 2

* Not including publications received in exchange ;
estimated purchase price £950.

4442

£2413 16 11

Restoration Fund

£		£ s. d.	£ s. d.
	By Balance at 31 March 1960 :—		
	Current Account at Bank.....	66 15 9	
	Deposit Account at Bank.....	1721 13 8	
	Deposit Account Post Office Savings Bank.....	57 10 10	
1838			1846 0 3
1838			£1846 0 3

Account

£		£ s. d.
3	By Postage on Library Books.....	4 5 0
36	„ Balance at 31 March 1960.....	32 14 0
39		£36 19 0

Investments on 31 March 1960

£	s.	d.	
<i>General Account</i>			
1548	8	9	British Transport 3% Guaranteed Stock 1978-88.
3260	1	3	2½% Consolidated Stock.
1000	0	0	3½% London County Consolidated Stock 1958-68.
1139	13	0	3% Savings Bonds 1955-65.
176	19	3	3% Savings Bonds 1960-70.
274	5	5	3% Treasury Stock.
1172	6	3	3½% War Loan 1952 or after.
396	0	0	Barclays Bank Ltd. Ordinary Stock.
100	0	0	The Employers' Liability Assurance Corp. Ltd. £1 shares fully paid.
25	0	0	The Globe Telegraph and Trust Co. Ltd. Ord. Stock.
93	5	0	Lonsdale Investment Trust Ltd. Ord. Stock.
544	5	0	Peninsular Investment Co. Ltd. 5s. shares fully paid.
500	0	0	Charterhouse Group Ltd. £1 Ordinary Shares fully paid.
135	0	0	Eagle Star Insurance Company Ltd. 10s. Ordinary Shares.
1069	units		The Pension (Equities) Unit Trust Fund.
			Market Value 31 March 1960 £13,455
			" " " 1959 £10,116

£	s.	d.	
<i>Library Account</i>			
471	18	9	British Transport 3% Guaranteed Stock 1978-88 (Bentham Bequest).
191	12	7	4% Australian Stock 1961-64 (Walker & Morey Bequests).
107	2	1	2½% Consolidated Stock (Stebbing Bequest).
1414	7	11	2½% Consolidated Stock (Flintoff Bequest).
530	0	0	3% Savings Bonds 1960-70 (Tagart Bequest).
103	12	5	Surrey County Council 3% 1961-66 (Wakehurst Bequest).
390	0	0	Glasgow Stockholders Trust Ltd. Ord. Stock.
325	0	0	The Globe Telegraph and Trust Co. Ltd. Ord. Stock.
340	0	0	Lonsdale Investment Trust Ltd. Ord. Stock.
143	15	0	Peninsular Investment Co. Ltd. 5s. shares fully paid.
138	15	0	The Scottish National Trust Co. Ltd. Ord. Stock.
			Market Value 31 March 1960 £7314
			" " " 1959 £5778

£	s.	d.	
<i>Special Accounts</i>			
232	5	0	Metropolitan Water Board 3% B. Stock (Westwood Bequest).
667	14	2	" " " " (Hooker Lecture Fund)
163	11	5	" " " " (Goodenough Fund).
557	12	1	2½% Consolidated Stock (Crisp Award Fund).
156	7	2	" " " " (Westwood Fund).
74	14	6	" " " " (Hooker Lecture Fund).
149	8	10	" " " " (Goodenough Fund).
381	15	9	3% Savings Bonds 1955-65 (Staff Pension Fund).
12	10	2	" " " " (Staff Pension Fund).
100	0	0	" " " " 1960-70 (Minchin Fund).
102	3	11	3½% War Loan 1952 or after (Trail Award Fund).
<i>Mrs. Jane Jackson Bequest :</i>			
Investments transferred to the Society :			
1836	19	0	British Transport 3% Gtd. Stock 1978-88.
666	12	1	Liverpool 3% Stock 1954-64.
450	0	0	Middlesex 3½% Stock 1957-62.
416	15	10	Wakefield 3½% Stock 1958-63.
			Market Value 31 March 1960 £4226
			" " " 1959 £1661

CRANBROOK, *Treasurer*

We have (in conjunction with the Professional Auditors, who certify as to all details) audited the Accounts of the Society for the year ended 31 March 1960 and found them correct.

We have verified the investments and Bank Balances.

28 April 1960.

W. B. KEEN & Co., *Chartered Accountants*,
Finsbury Circus House,
Blomfield Street, London, E.C.2.

A. W. Exell	} <i>Audit Committee</i>
H. R. Hewer	
E. Trewavas	
H. L. G. Stroyan	
J. P. M. Brennan	
R. Ross	

Statement of the Photographic Recording
of the LINNAEAN HERBARIUM

	£	s.	d.		£	s.	d.
The Nuffield Foundation Loan—interest free	600	0	0	International Documentation Centre, Stockholm			
International Documentation Centre, Stockholm				Agreed share of cost of producing negative film of	600	0	0
Sale of sets of microfiche—agreed percentage	168	0	0	Linnaean Herbarium	168	0	0
				Balance at 31 March 1960—Current Account			
					<u>£768</u>	<u>0</u>	<u>0</u>

BENEFACTIONS

1956-60

LIST *in accordance with Bye-Laws, Chap. 17, Sect. 1, of all Donations of the amount or value of Twenty pounds and upwards, received during the past five years.*

1956

The Royal Society: Grant-in-aid of publications, £1000.

Mr F. J. F. Barrington, F.L.S.: Legacy of £1000.

Sir Sidney F. Harmer, K.B.E., F.R.S., P.P.L.S.: Legacy of £200.

Mr Henry Rissik Marshall, F.L.S.: Gift of books to the Library.

1957

The Royal Society: Grant-in-aid of Publications, £410, and £400 Library Assistance Grant for the purchase of foreign periodicals.

His Majesty The King of Sweden: Gift to assist upkeep of Linnean MSS., £100.

1958

The Royal Society: Grant-in-aid of publications, £1000.

Dr Hugh Scott, F.R.S., F.L.S.: £500 towards cost of paper in Vol. 170 of the Proceedings.

Dr B. O. Dodge, F.M.L.S.: Gift of \$100 for general purposes.

Dr A. Tindell Hopwood, F.L.S.: Gift of books to the Library.

The John Innes Horticultural Institution: (£10, 1956, 1957 and 1958) £30.

1959

The Ray Society: Gift in appreciation of Library facilities granted £50.

The Royal Society: Grant-in-aid of publications £600 and Libraries Assistance Grant-in-aid, £650.

Imperial Chemical Industries, Ltd.: Gift to Library Fund, £21 and Grant towards cost of illustrations in *J. Bot.* No. 367, £115.

Imperial Forestry Institute, Oxford: Grant towards cost of illustrations in *J. Bot.* No. 364, £60.

Mr I. Henry Burkill, F.L.S.: Gift towards cost of his illustrations in *J. Bot.* No. 367, £35.

1960

The Royal Society: Libraries Assistance Grant-in-aid, £1000.

The John Innes Institute: Gifts to the Library Fund (£10, 1959 and £10, 1960), £20.

Anonymous Donation: £1107.

Mrs Jane Jackson Bequest: Income to increase the remuneration of the staff of the Society. Stock, *nominal value*, £3370.

LIBRARY MAINTENANCE APPEAL

Amounts of £20 and upwards received during the period November 1960 to 4 January 1961 :—

	£	s.
The Drapers' Company (promised by instalments over seven years).....	525	
The Pharmaceutical Society of Great Britain.....	525	
Miss E. D. Brain, F.L.S.....	250	
Imperial Chemical Industries, Ltd.....	250	
Dr Joan Evans, President, Society of Antiquaries.....	100	
Lady Barlow, F.L.S.....	100	
Professor C. F. A. Pantin, F.R.S., P.L.S.....	100	
Glaxo Laboratories, Ltd.	100	
Allan & Hanbury, Ltd.....	52	10
Boots Pure Drug Co., Ltd.....	50	
Albright & Wilson, Ltd.....	50	
Mrs C. M. Snow, F.L.S.....	50	
Esso Petroleum Co., Ltd.	50	
Butterworths, Publishers.....	26	5
Lord Cranbrook, Treas. L.S.....	26	5
National Provincial Bank, Ltd.	26	5
Westminster Bank, Ltd.	26	5
Midland Bank, Ltd.	26	5
Lloyds Bank, Ltd.	26	5
Barclays Bank, Ltd.	26	5
Sir Edward Salisbury, F.R.S., F.L.S.....	21	

ADDITIONS AND GIFTS TO THE LIBRARY

1959-60

Note.—Names of donors are given in square brackets. Separate copies of papers which are included in periodicals received by the Library are no longer catalogued.

Aaronsohn, Aaron. *See* Oppenheimer, H. R.

Abhandlungen und Berichte aus dem Staatlichen Museum für Tierkunde in Dresden. Vol. 24→ 8vo. *Leipzig*, 1958→

Acta Biologica Cracoviensia. Série; Botanique and Zoologie. Vol. 1 → 8vo. *Cracovie*, 1959→

Alston, A. H. G. The Ferns and Fern-Allies of West Tropical Africa. A Supplement to the second edition of the Flora of West Tropical Africa. Pp. vii + 89. 8vo. *London*, 1959.

Andrews, H. W. & Smith, Kenneth G. V. A Note on the Prey of *Dioctria linearis* Mg. (Dipt. Asilidae). (Repr. Ent. mon. Mag., vol. 94, 1958.)

[HOPE DEPT ENT., OXFORD.]

Anfinsen, Christian B. The Molecular Basis of Evolution. Pp. xiii + 228. 8vo. *New York*, 1959.

[PUBLISHERS.]

The Annals of Zoology. The Academy of Zoology. Vol. 1→ 8vo. *Agra*, 1957→

Arnold, Chester A. Palaeobotany and Plant Classification. Pp. 7. 8vo. *Lucknow*, 1959.

[BIRBAL SAHNI INST.]

Askew, R. R. A Revision of the British Species of the Genus *Olynx* Forster (Hym., Eulophidae). (Repr. Ent. mon. Mag., vol. 95, 1959.)

[HOPE DEPT ENT., OXFORD.]

— — A New Species of *Hobbya* (Hym., Pteromalidae) from Britain. (Repr. Ent. mon. Mag. vol. 95, 1959.)

[HOPE DEPT ENT., OXFORD.]

— — *Harpiophorus lepidus* Klug (Hym., Tenthredinidae) in Berkshire. (Repr. Ent. mon. Mag., vol. 94, 1958.)

[HOPE DEPT ENT., OXFORD.]

Audus, L. J. Plant Growth Substances. Ed. 2. Pp. xxii + 553. 8vo. *London*, 1959.

[AUTHOR.]

- Backeberg, Curt.** Die Cactaceae Handbuch der Kakteenkunde. Vols. I and II. Pp. xxiii + 1360 & 106 pl. 8vo. *Jena*, 1958-59. [NATIONAL BOOK LEAGUE.]
- Banks Letters.** See **British Museum (Natural History)**—**Dawson, W. R.**
- Bannerman, David A. & Bannerman, Mary W.** Birds of Cyprus. Pp. lxix + 384. 4to. *London*, 1958.
- Barkman, J. J.** Phytosociology and Ecology of Cryptogamic Epiphytes. Pp. xiii + 628 and Suppl. 8vo. *Assen*, 1958.
- Barnes, Claude T.** The Natural History of a Mountain Year. (The Natural History of a Wasatch Winter, Spring, Summer and Autumn.) Pp. 96 + 98 + 100 + 98. 8vo. *Salt Lake City*, 1957-59. [AUTHOR.]
- Beck, Hanno.** Gespräche Alexander von Humboldt. Pp. xxii + 492. 8vo. *Berlin*, 1959. [DEUTSCHE AKAD. WISS. BERLIN.]
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THE PLANKTONIC CRUSTACEA OF THE PETULA TRANSATLANTIC EXPEDITION

By FRANK EVANS

(With 2 text-figures and 3 tables)

Dove Marine Laboratory, Cullercoats, Northumberland

(Communicated by the Zoological Secretary)

DURING the winter of 1953-54 a 12-ton sailing yacht, the *Petula*, with a small raft in tow, drifted from Dakar to Barbados (Evans, 1955). Along her route (Fig. 1) oceanographical and meteorological studies close to the sea surface were systematically conducted. The voyage was begun in November and occupied a little under 12 weeks, during which the ship drove 2656 miles at an average speed of 1.38 knots. The route lay along the North Equatorial Current which flows westwards from the African to the American continent approximately between the latitudes of 20° N. and 10° N.; this region is characterized by high sea and air temperatures and by a tropical, largely high-oceanic fauna.

Tow netting during the voyage was conducted as a routine. Hauls were begun at midnight, 06.00, 12.00 and 18.00 G.M.T., each haul lasting for six hours. In this way 178 hauls were secured over a period of 77 days, with a net in the water 58 per cent of the possible time. The plankton nets used followed the design of the standard (International) net described by Ostenfeld & Jespersen (1924), with a ring diameter of 50 cm. and meshes of 60 or 80 rows to the inch. Flow through the net was not measured, and in the results plankton volumes and numbers of animals are given per mile sailed. A column 50 cm. in diameter and one mile long occupies 364 cu. m. The work of Curie & Foxton (1957) has suggested that perhaps 90 per cent of this volume was filtered through the net in each mile.

Plankton hauls have been grouped into 26 periods, each period except the first occupying three days. Period 1 occupies 30 hours. From an examination of the physical records (Table I) and of the biological records, especially the plankton volume taken per mile (Table II and Fig. 2) it is possible to distinguish at least six regions along the route.

These are:

Region 1	African region	Periods 1-4
Region 2	C. Verde Is. region	Periods 5-7
Region 3	First Oceanic region	Periods 8-10
Region 4	Second Oceanic region	Periods 11, 12
Region 5	Third Oceanic region	Periods 13-21
Region 6	American region	Periods 22-26

Regions 3 and 5 are largely similar in character but are separated by the outstandingly rich Region 4. Regions 5 and 6 are not strongly differentiated in total volume of plankton caught but the latter region shows a change in physical characteristics and in the appearance within it of a number of mero-planktonic animals.

Certain crustacea, notably the decapod larvae, were taken only at the beginning and end of the voyage (Table III). Apart from the oceanic Pennaeid *Sergestes atlanticus*, only the Stenopidea extended westwards to the Third

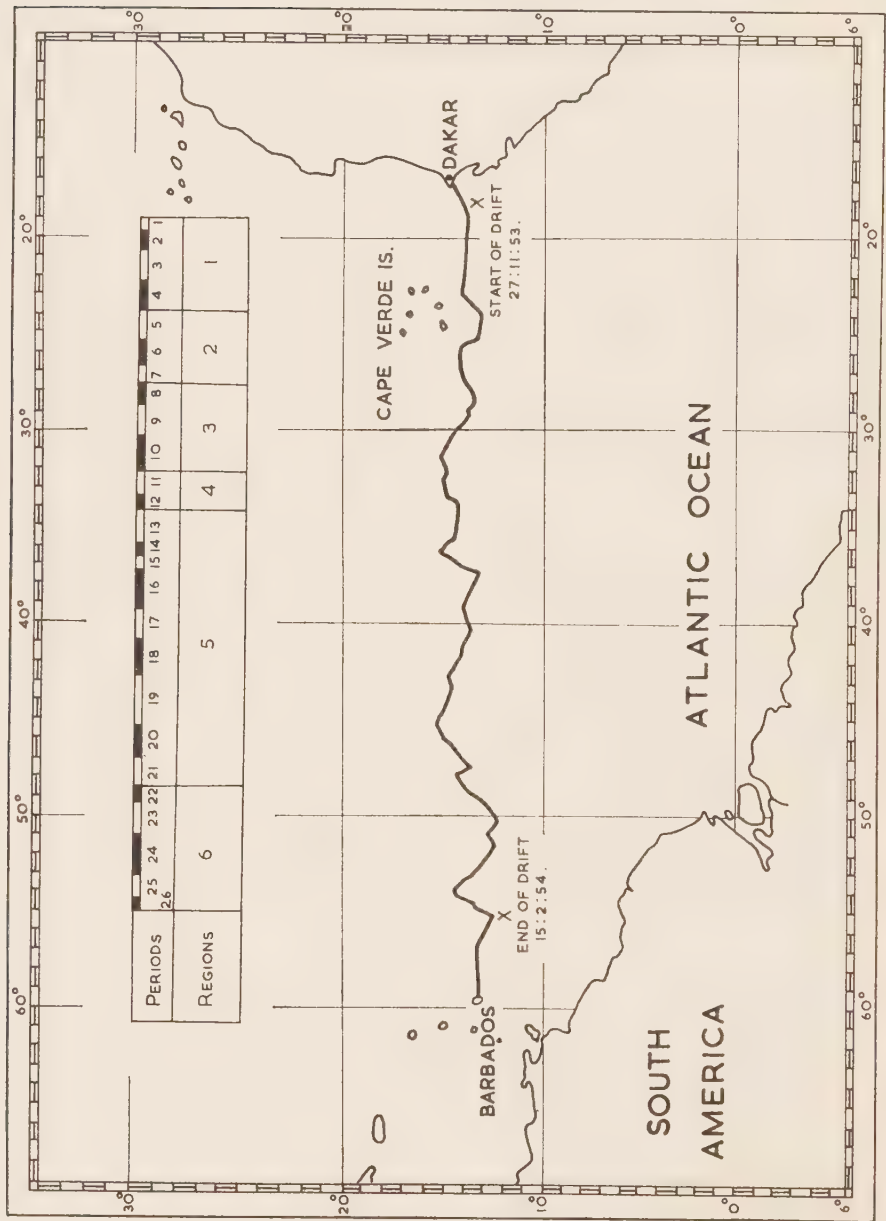


FIG. 1.—Track of the *Petula* showing the regions traversed.



Fig. 2.—Plankton volumes (ml. per mile sailed through the water) in each 3-day period of the voyage.

TABLE I.—Sea temperature, density, salinity and pH at each period

Period	Temperature		Density and salinity			pH	
	No. of obs.	(°C.)	No. of obs.	Sigma- <i>t</i>	S‰	No. of obs.	pH
1	4	26.72	1	22.8	34.9	0	—
2	12	26.83	3	22.8	35.1	3	8.26
3	12	26.22	3	22.9	35.1	3	8.16
4	12	25.39	3	23.7	35.6	3	8.11
5	12	25.44	4	23.9	35.8	3	8.18
6	12	25.33	5	23.8	35.7	3	8.19
7	12	25.06	2	23.7	35.5	3	8.20
8	12	25.33	3	23.6	35.5	2	8.21
9	12	25.11	4	23.6	35.3	3	8.25
10	12	24.78	6	24.0	35.8	3	8.21
11	12	24.72	5	24.2	36.1	3	8.24
12	12	24.94	4	24.0	35.8	3	8.25
13	12	25.11	5	23.8	35.7	3	8.22
14	12	25.11	6	24.0	36.0	3	8.17
15	12	25.11	4	23.7	35.7	3	8.21
16	12	25.00	1	23.9	35.7	3	8.17
17	12	25.39	3	24.1	36.2	3	8.16
18	12	25.44	1	24.1	36.3	2	8.14
19	12	25.11	1	24.0	35.8	2	8.21
20	12	25.17	0	...	...	3	8.11
21	12	25.33	1	23.7	35.6	2	8.05
22	12	25.67	3	23.3	35.3	3	8.05
23	12	26.11	3	23.4	35.5	3	7.94
24	12	26.11	0	...	...	1	7.90
25	12	25.67	0	...	...	0	...
26	12	25.61	0	...	...	0	...

TABLE II.—Numbers per mile of the

[illegible]

TABLE III.—Distribution of decapod larvae along the route

	Last taken in Eastern Atlantic Long. W.	First taken in Western Atlantic Long. W.
Thalassinidae	24° 57'	...
Megalopa larvae	25° 29'	...
Zoea larvae	25° 35'	...
Palaemonidae (<i>Retrocaris</i>)	25° 38'	50° 22'
Hippolytidae	27° 59'	50° 50'
Amphionidae	27° 59'	49° 46'
Phyllosoma larvae	31° 11'	50° 22'
Hoplophoridae (<i>Acanthephyra</i>)	33° 43'	49° 38'
Stenopidea	36° 24'	50° 50'

commonest Crustacea at each period

Period												
11	12	13	14	15	17	18	19	21	22	23	24	26
10.5	9.3	0.9	1.2	3.6	3.2	0.9	1.1	0.8	3.3	1.8	1.3	0.6
422	149	3	17	57	44	20	20	0	125	47	23	0
0	0	0.1	0.1	0.9	0.6	0.2	0.6	0.3	5.3	2.4	2.4	0
215	404	14	7	4	40	11	10	5	59	16	3	13
167	128	1	1	19	43	5	10	0	23	27	8	7
120	43	1	4	7	41	6	2	0	7	5	2	3
7.2	32.9	1.7	1.8	1.3	2.3	3.4	2.0	0.2	4.7	0.8	1.6	0
709	398	4	32	55	108	20	42	3	105	80	19	16
1272	1239	7	17	115	25	12	22	0	116	56	26	120
329	399	7	67	351	178	29	100	8	263	179	19	1
18.4	7.2	2.2	4.3	7.2	2.2	0	9.9	0	21.4	9.9	23.4	0.1
66.7	144.0	5.5	19.3	33.3	8.8	0	7.1	0.5	32.7	39.7	22.6	0
0.1	1.6	0.1	0.1	0.9	0.1	0	0.3	0.1	0.3	0.6	0.4	0.1
1.8	0	0.1	0.2	0.4	2.3	0.1	0.2	0	1.1	1.4	0.1	0
9	0	3	3	15	18	7	0	0	26	14	1	1
133	290	1	10	29	3	0	2	0	58	10	2	0
48.6	29.6	0.4	2.5	5.4	7.7	0.5	5.3	0.1	10.6	11.3	0.8	0
15	18	0	0	0	0	0	0	0	0	1	1	0
543	216	2	3	56	16	16	62	0	207	72	7	20
375	480	5	42	427	325	29	253	0	204	136	21	4
4	20	1	7	24	124	1	11	0	89	27	1	0
1728	2651	5	8	16	13	4	13	0	35	22	4	8
82	96	1	4	4	1	1	15	0	8	4	4	0
284	219	2	4	4	18	1	9	2	92	8	2	1
4243	3898	40	92	135	302	43	137	27	457	249	37	5
5.0	1.4	0	0.2	0.9	0	0	0	0	0.7	0.5	0	0
19	30	1	4	22	5	0	3	0	35	6	3	0
95	71	0	3	8	0	0	0	0	21	9	2	0
28	35	0	1	3	3	0	0	0	9	3	0	0
251	439	6	30	171	138	4	27	6	166	41	10	0
5.9	2.0	1.4	1.7	3.6	1.2	0	2.5	0.2	3.0	2.6	0.8	0
62.1	23.4	0.8	4.5	14.4	1.2	0	3.0	0	38.7	17.2	0.5	0
2	0	0	0	0	0	0	0	0	1	1	1	0
0.3	1.6	0	0.1	0.4	1.1	0.5	0.6	0	1.1	0.7	1.6	0
5.6	1.4	0.2	0.7	14.4	6.1	0	0.1	0.1	2.3	6.9	0	0.1
510	336	3	18	77	216	25	38	0	541	58	18	7

Oceanic region, while many larval decapods ceased at the C. Verde Is. In the western Atlantic most of the forms which had been taken in the east reappeared, the crabs being a notable exception. Their reappearance was very sharply marked geographically, six families returning to the catches between longitudes 49° 38' W. and 50° 50' W.

THE *Petula* CRUSTACEA COLLECTION

In this annotated list of species the name of each animal is followed by a reference, in brackets, to the source from which identification was made. Authorities for the distribution quoted are given in brackets at the end of each item.

OSTRACODA

Conchoecia atlantica (Lubbock). (Vávra, 1906).—Taken in five hauls in Regions 2, 3 and 5. It did not occur in the rich Region 4. A high-oceanic form.

Distribution.—Tropical and temperate regions of the three great oceans (Brady, 1880, as *Halocypris atlantica* Lubbock; Vávra, 1906).

Conchoecia curta Lubbock. (Skogsberg, 1920).—Taken in 75 hauls. There were two important maxima, one in Region 2, the other in Region 4; otherwise the species was rather thinly distributed across the ocean.

Distribution.—Tropical and temperate regions of the Atlantic, also recorded from the Indian and Pacific Oceans (Skogsberg; Iles, 1953).

Conchoecia echinata Muller. (Vávra, 1906, as *C. notocera*).—A single specimen taken at Period 22 in Region 6.

Distribution.—Tropical and temperate regions of the Atlantic (Vávra; Iles, 1953).

Conchoecia elegans Sars. (Skogsberg, 1920).—Taken in six hauls. Found at and immediately following Region 4 and again in Region 6.

Distribution.—Widely distributed in the Atlantic and Indian Oceans and in the Arctic and Antarctic. It does not yet seem to have been reported from the Pacific. It is interesting to note that this was easily the commonest ostracod species taken by the *William Scoresby* off SW. Africa; along the *Petula*'s route it was much less common than *C. curta* (Skogsberg; Iles, 1953).

Conchoecia obtusata Sars. (Skogsberg, 1920).—Taken only in Period 7, a single specimen.

Distribution.—Skogsberg gives the distribution of this species as 'the northern part of the Atlantic Ocean, chiefly north of latitude 60°, and the Arctic Ocean.' He also describes a variety from the Antarctic. His limits are clearly too restricted, and Iles (1953) records it from the Benguela Current in 23° S. Ekman (1953) goes further and describes it as a bathypelagic species which is truly cosmopolitan with regard to temperature. The present record tends to support Ekman's statement. It is probably a stray wanderer from deep water; the station at which it occurred gave us two other unusual crustaceans, one a hippolytid and the other the amphipod *Hemityphis rapax*.

COPEPODA

Acartia danae Giesbrecht. (Rose, 1933).—Taken in eight hauls, in the eastern Atlantic only, in Periods 2–14.

Distribution.—The *Carnegie* did not take this species in the western Atlantic and Wilson (1932) gives only a single record for Woods Hole. Twenty-one specimens were taken by the *Terra Nova* off Rio de Janeiro; nevertheless it seems commoner in the eastern than the western Atlantic. Found also in the Indian and Pacific Oceans (Rose).

Acartia negligens Dana. (Rose, 1933).—Taken in two hauls, one in Region 4, the other in Region 6.

Distribution.—Temperate and tropical Atlantic, Indian Ocean (Farran, 1929; Rose).

Acrocalanus longicornis Giesbrecht. (Sewell, 1929).—Taken in 92 hauls. Well represented in Region 1 but much less common in Region 2. A considerable increase was recorded in the rich Region 4 after which the level fell away to perhaps 30 per mile. There was a small peak of 125 per mile at Period 22 in Region 6.

Distribution.—Tropical and subtropical regions of the three great oceans (Sewell, 1947).

Calocalanus pavo Dana. (Rose, 1933).—Taken in 140 hauls. Well represented in Region 1, its maximum appearing during Period 2. Though still common, its numbers were reduced in Region 2. It was numerous during Period 8 and again during Periods 11 and 12. After this its frequency only once (Period 22) rose above 100 per mile. It is thus seen to be much commoner on the eastern section of our route.

Distribution.—Tropical and temperate regions of the three great oceans (Sewell, 1947).

Candacia pachydactyla Dana. (Rose, 1933).—Taken in 93 hauls. Moderately represented in Regions 1 and 2. An outstanding increase occurred at Region 4, after which, with some fluctuations, notably during Period 17, the species remained at a low density for the remainder of the voyage.

Distribution.—Tropical and temperate regions of the three great oceans (Sewell, 1947).

Centropages typicus Kröyer. (Rose, 1933).—Taken in three hauls, the first in Region 1 and the other two in Region 4.

Distribution.—A more widespread form in the Atlantic than *C. violaceus* (below), but is much less well represented in tropical regions, as our records show. It is not found outside the Atlantic and adjoining seas (Sars, 1903, Wilson, 1942).

Centropages violaceus (Claus.) (Rose, 1933).—Taken in 79 hauls, its occurrence was very similar to that of *Candacia pachydactyla*.

Distribution.—Temperate Atlantic (Rose), tropical Atlantic, central and south Pacific (Wilson, 1942), extremely rare in Indian waters (Sewell, 1932).

Clausocalanus furcatus (Brady).—See under *Paracalanus aculeatus*.

Clytemnestra scutellata Dana. (Rose, 1933).—Taken in six hauls during Periods 2-12; its occurrence resembles that of *Acartia danae*.

Distribution.—Widely distributed in the three great oceans (Sewell, 1947). Scarcity in the present records suggests that the tropical Atlantic may be an expatriate region.

Corycaeus speciosus Dana. (Dahl, 1912; Rose 1933).—Taken in 135 hauls. Particularly well represented in Regions 1, 2 and 4. Subsidiary maxima occurred at Periods 8, 17, and 22. A very common species.

Distribution.—Tropical and temperate regions of the three great oceans (Rose).

Corycaeus (Onychocorycaeus) latus Dana. (Dahl, 1912; Rose, 1933).—Taken once in mid-ocean and once in Region 6. This species was not at first distinguished from *C. speciosus* and is probably commoner than these figures indicate.

Distribution.—Tropical and temperate regions of the three great oceans (Rose).

Copilia mirabilis Claus. (Rose, 1933).—Taken in 13 hauls. Found on both sides of the Atlantic, in both oceanic and coastal water.

Distribution.—Tropical and temperate regions of the three great oceans (Sewell, 1947).

Corycella carinata Giesbrecht. (Rose, 1933).—Taken in 151 hauls; particularly well represented in eastern coastal waters and at Region 4, but very common almost everywhere. The most abundant copepod in the collection.

Distribution.—Tropical and subtropical regions of the three great oceans (Wilson, 1932; Rose).

Eucalanus sp.—A number of juveniles of this genus, most probably of species **attenuatus** Dana, occurred in 16 hauls. The species occurred only three times west of longitude 20° 56' W. and not at all west of 25° 36' W. It is clearly a coastal form in the eastern Atlantic, at least in its juvenile stage.

Euchaeta marina (Prestandrea). (Rose, 1933).—Taken in 139 hauls. It was commonest in Regions 1 and 2, but dense populations occurred at intervals throughout the voyage.

Distribution.—Tropical and temperate regions of the three great oceans (Sewell, 1947).

Euchirella pulchra (Lubbock). (Wilson, 1932; Sewell, 1947).—Taken in four hauls, in Regions 1 and 2 only.

Distribution.—Tropical and temperate regions of the three great oceans (Sewell, 1947). The present limited occurrence of this animal reflects its range quite inadequately.

Labidocera acutifrons (Dana). (Rose, 1933).—Found in the first three hauls of the voyage in considerable numbers; thereafter it disappeared.

Distribution.—Tropical and temperate regions of the three great oceans and as far south as the Antarctic. High seas records are rare and the present note suggests that it is a neritic species.

Labidocera nerii Krøyer. (Wilson, 1932).—Taken in 44 hauls. Despite its local abundance in Region 1 this species is on the whole better represented in the western than in the eastern Atlantic, and more especially in Regions 3 and 5, where other copepods tend to be less numerous.

Distribution.—Tropical and temperate Atlantic, Malay Archipelago. Taken only three times in the Pacific, always in tropical waters (Wilson, 1932 and 1942). Said to be a rare species, but it was much more commonly taken by the *Petula* than was *L. acutifrons*.

Lucicutia flavicornis (Claus). (Rose, 1933).—Taken in 44 hauls. Poorly represented in Region 1 and only moderately so in Region 2. It attained a considerable maximum in Region 4 and was moderately represented in Region 6. An oddly distributed form whose fluctuations do not reflect those of other copepods.

Distribution.—Widely distributed throughout the three great oceans (Sewell, 1947).

Macrosetella gracilis (Dana). (Rose, 1933).—Taken in 51 hauls. It was commonest in Regions 1 and 2; its numbers were thereafter much reduced until by longitude 30° 04' W. it had disappeared, not reappearing until longitude 49° 54' W. and then only in very small numbers. These results suggest that it tends to a neritic existence.

Distribution.—Widely distributed throughout the three great oceans (Sewell, 1947); temperate and tropical regions of the three great oceans (Rose).

Microsetella norvegica (Boeck). (Rose, 1933).—This copepod, a single specimen of which was taken in Period 8, is perhaps too small to be fairly represented in our catches and some specimens may have passed through the nets.

Distribution.—There seems to be some doubt about the range of this species. Both Ekman (1953) and Sewell (1947) regard it as cosmopolitan, Sewell noting

its presence in both the Arctic and Antarctic. The *Carnegie* frequently took it at the surface in the tropical Atlantic. Yet Fish (1955) states that in the western Atlantic it is found only as far south as Chesapeake Bay (37° N.), and more southerly records from the United States seem to be lacking.

Miracia efferata Dana. (Wilson, 1932).—Taken in 89 hauls. This species, although well represented in the rich hauls of Period 1 does not otherwise appear strongly in coastal waters, either of the African or C. Verde Is. regions. By far the densest concentrations appear in Region 4 but it is also well represented in Regions 3, 5 and 6. It seems to be a high-oceanic form, rather commoner in the western Atlantic than the eastern.

Distribution.—Widely distributed throughout the three great oceans (Sewell, 1947).

Nannocalanus minor (Claus). (Rose, 1933, as *Calanus minor* Claus; Sewell, 1929).—Taken in 129 hauls; particularly well represented in Regions 1 and 2 and also in Region 4, but very common everywhere. Outstandingly dense concentrations appeared during Periods 15 and 17 in Region 5.

Distribution.—Tropical and temperate regions of the three great oceans. Considerable range of depth (Sewell, 1947).

Neocalanus gracilis (Dana). (Rose, 1933, as *Calanus gracillius* Dana).—Taken in 62 hauls. Although this species, which has a wide vertical range, is said to occur only occasionally at the surface (Sewell, 1947) it is well represented in the *Petula* collection. Curiously, its maximum concentration occurred at Period 17 in Region 5, where plankton generally tended to be thin. It is also unusual in that unlike other common copepods it did not appear during Period 1. Otherwise it is fairly evenly distributed across the Atlantic.

Distribution.—Widely distributed throughout the three great oceans (Sewell, 1947).

Neocalanus robustior (Giesbrecht). (Rose, 1933, as *Calanus robustior* Giesbrecht).—Taken twice, once in Period 13, and once in Period 23.

Distribution.—Tropical and subtropical regions of the three great oceans. It lives in general a little below the surface and has a well-marked diurnal migration (Rose).

Oithona spp. (**O. helgolandica** (Claus) and **O. setigera** Dana. (Rose, 1933).—Taken in 117 hauls. The specimens examined were almost exclusively *O. helgolandica*, but two copepods from longitude 29° 10' W. which I had already passed as of this species in fact proved to be *O. setigera*. I re-examined some of the material but was unable to find further examples. It is nevertheless possible that some escaped my notice. *Oithona* was well represented in the eastern half of the Atlantic from Regions 1 to 4. From there numbers sank precipitously, recovering only during Periods 17 and 22. The species seems in general more successful in the eastern Atlantic.

Distribution.—*O. helgolandica* is widely distributed throughout the three great oceans and in both polar seas (Rose; Ekman, 1953)

Oncaea conifera Giesbrecht. (Giesbrecht, 1892; Rose, 1933).—Taken in three hauls, in Periods 11, 13 and 22.

Distribution.—Because of doubtful identification its range is uncertain. Rose gives it as cosmopolitan (three major oceans and polar seas). Sewell states that in the Arctic region it is replaced by *O. borealis* Sars. The Antarctic form described by Giesbrecht (1892) and Farran (1929) is not the typical form captured aboard the *Petula*.

Oncaea media Giesbrecht. (Rose, 1933).—Taken in 147 hauls. Although this species occurred in more hauls than any except *Corycella carinata* it is far better represented in the eastern Atlantic than in the western. After Region 4 what was until then the dominant copepod in every period faded into insigni-

ficance. In this respect its distribution recalls that of *Oithona helgolandica*.

Distribution.—Widely distributed in the three great oceans (Wilson, 1932; Rose).

Oncaea venusta Philippi. (Rose, 1933).—Taken in 90 hauls. Well represented in Region 1; less so but still very common in Region 2; after this its numbers generally declined despite a local increase in Region 4. Although represented the width of the Atlantic this species appears to flourish mainly in eastern coastal waters. The form taken aboard the *Petula* was var. *venella* Farran (1929).

Distribution.—Widely distributed in the three great oceans (Rose).

Paracalanus aculeatus Giesbrecht. ***Clausocalanus furcatus*** (Brady). (Rose, 1933).—One or both species occurred in 161 hauls. These two species could not usually be distinguished without dissection and were perforce counted together. A number of samples of 50 specimens were selected from various hauls and separated under the high power of the microscope. The results were:—

Longitude W.	<i>P. aculeatus</i>	<i>C. furcatus</i>
22° 35'	18	32
29° 10'	7	43
33° 12'	20	30
37° 08'	8	42
49° 34'	12	38

suggesting that *C. furcatus* is perhaps twice as common as *P. aculeatus*. Specimens of *P. aculeatus* with abnormal 5th thoracic limbs similar to those figured by Sewell (1929, p. 65) occurred in longitudes 19° 36' W. and 19° 49' W. In the present cases the abnormality appeared more extreme in that one limb had become divided into four segments and the other into three instead of the usual two segments on each side. A corresponding abnormality, which seems not to have been previously reported, was found in a specimen of *C. furcatus* caught in longitude 43° 25' W.—Here a 5th thoracic limb contained an extra segment, but the typical termination remained.

Distribution.—Both species occur in the tropical and temperate regions of the three great oceans (Sewell, 1947).

Pleuromamma abdominalis (Lubbock). (Rose, 1933).—Taken in 34 hauls. Poorly represented in Region 1 and only moderately so in Region 2. Maxima occurred in Region 4; at Period 15 in Region 5; and at Period 22 in Region 6. Although found the width of the Atlantic it seems commoner in the western part.

Distribution.—Tropical and temperate Atlantic, Indian Ocean (Rose).

Pleuromamma borealis (Dahl). (Farran, 1929; Rose, 1933).—Taken in 14 hauls. Found at one station in Region 2; just before and at the rich Region 4; and in Region 6. This species has caused some confusion through doubtful identification but it may be clearly recognized from the description given by Farran.

Distribution.—Because of this doubtful identification its range is somewhat uncertain. Rose gives it as 'Atlant. nord, O. Irlande, golfe de Gascogne' and Farran took three specimens between 50° and 60° S., south of New Zealand. The present tropical records considerably extend its known range.

Pleuromamma gracilis (Claus). (Rose, 1933).—Taken in 27 hauls. Poorly represented across the width of the Atlantic with the exception of two places, Region 4, and Period 22 at the beginning of Region 6. It was taken by the *Carnegie* on 12 occasions, every one at night, and was five times recorded as common or abundant. Wilson (1942) concluded that the species migrated to the surface after dark. This was our experience aboard the *Petula*, for we never took it during a purely daytime haul.

Distribution.—Widely distributed in the three great oceans (Wilson, 1932; Rose).

Pleuromamma piseki Farran. (Farran, 1929; Rose, 1933).—Taken in 21 hauls. Found the width of the Atlantic, rarely in great numbers. Slightly commoner on the western side of the Atlantic than on the eastern. I found, as Farran did, that specimens often occurred in the same hauls as *P. gracilis*.

Distribution.—Approximately as *P. gracilis* but extending less far into cold water (Farran).

Pleuromamma xiphias (Giesbrecht). (Rose, 1933).—Found only once, in longitude 33° 30' W. (Region 4), a single female.

Distribution.—Widely distributed in the three great oceans and in the Antarctic (Sewell, 1947).

Pontellina plumata (Dana). (Rose, 1933).—Taken in 30 hauls. Moderately represented along the length of the route; somewhat commoner on the eastern side of the Atlantic than on the western. Notable maxima occurred in Regions 1 and 4.

Distribution.—Tropical and temperate regions of the three great oceans (Rose).

Pontellopsis regalis (Dana). (Rose, 1933).—Taken in 12 hauls. Found from Regions 1 to 5 but not in Region 6, although it has earlier been recorded from there.

Distribution.—Generally confined to the tropical and subtropical regions of the three great oceans (Sewell, 1947).

Rhincalanus cornutus Dana. (Rose, 1933).—Taken in three hauls (longitudes 20° 52', 49° 34' and 50° 50' W.) in near-shore waters only.

Distribution.—Tropical and subtropical regions of the three great oceans. Sewell (1947) states that it is more usual for young stages of this species to be taken at the surface, but our specimens are all adult, both male and female. A stenothermal species.

Sapphirinia auronitens-sinuicauda Lehnhofer. (Rose, 1933).—Taken once in Period 7 and once in Period 12.

Distribution.—Tropical and temperate regions of the three great oceans (Rose).

Sapphirinia nigromaculata Claus. (Giesbrecht, 1892; Rose, 1933).—Taken in six hauls; first found in Region 2 but it occurred most frequently in Region 6.

Distribution.—Tropical Pacific, tropical and temperate regions of the Indian and Atlantic Oceans (Sewell, 1947).

Sapphirinia opalina-darwini Lehnhofer. (Giesbrecht, 1892 as *S. opalina* Giesbrecht; Rose, 1933).—Found twice in Region 6 (longitudes 51° 09' W.; 51° 32' W.).

Distribution.—Tropical and temperate regions of the three great oceans (Sewell, 1947).

Sapphirinia sali Farran. (Farran, 1929; Rose, 1933).—One station only, a male and female occurring together in the same haul in longitude 41° 26' W.

Distribution.—Indian and Pacific oceans, tropical and temperate Atlantic (Sewell, 1947).

Sapphirinia stellata Giesbrecht. (Giesbrecht, 1892; Rose, 1933).—This species, previously unknown from the eastern Atlantic, was taken in longitude 33° 19' W. in Region 4, and also in longitudes 49° 14' W. and 55° 00' W. in Region 6.

Distribution.—Tropical and subtropical regions of the three great oceans (Sewell, 1947). A stenothermal species.

Scolecithrix danae (Lubbock). (Rose, 1933).—Taken in 97 hauls. Well represented in Region 1 but only moderately so in Region 2. Its greatest con-

centration occurred in Region 4 and thereafter the species continued to be common. It thus seems to be more abundant on the western side of the Atlantic. Curiously, the specimens preserved in formalin tend to float. Rose notes that in life it is a surface-dwelling form.

Distribution.—Widely distributed in the three great oceans (Wilson, 1932; Rose).

Temora styliifera (Dana). (Rose, 1933).—Taken in 24 hauls. Well represented in Region 1 where it was very common during Period 2. From there onwards its numbers fell until over long stretches of the ocean it has quite disappeared. It reappeared in small numbers in Region 6. *Petula* records thus suggest that it flourishes principally as an eastern coastal form.

Distribution.—Tropical and temperate regions of the three great oceans (Wilson, 1932; Rose).

Temora turbinata (Dana). (Giesbrecht, 1892; Wilson, 1932).—Found only in longitude 25° 39' W. (Period 6), a single female.

Distribution.—Tropical and temperate Pacific, tropical and temperate Atlantic (Giesbrecht & Schmeil, 1898). Wilson (1932) writes that it is a rare species at Woods Hole. It was not taken by the *Carnegie* (Wilson, 1942) and seems generally scarce in the Atlantic. In contrast Farran (1929) describes it as 'in great abundance off North Island, New Zealand, sometimes constituting almost the entire gathering'.

Undinula vulgaris (Dana). (Sewell, 1929).—Taken in 130 hauls. Commonest in Regions 1 and 2 but dense concentrations occurred throughout the voyage. Frequency of occurrence very similar to that of *Euchaeta marina*.

Distribution.—Tropical and temperate regions of the three great oceans (Sewell, 1947).

CIRRIPEDEA

Cypris larvae, probably *Lepas* spp., were found in four hauls. The shape and small size of these organisms suggest that many may have passed through the plankton nets. The rich crop of barnacles which fringed the ship's water-line also suggest that *cypris* larvae were considerably more numerous in the sea than our records indicate.

AMPHIPODA

Anchylomera blossevillei M.-Edw. (Chevreux & Fage, 1925).—Taken in 51 hauls. Well represented in Region 1; thereafter a decline set in such that by Region 4 the species had disappeared. After this numbers slowly recovered, reaching a moderate level by Region 6. These records indicate a neritic tendency.

Distribution.—Tropical and temperate regions of the three great oceans (Chevreux & Fage).

Brachyscelus crusculum Sp. Bate. (Chevreux & Fage, 1925).—Taken in nine hauls confined to Regions 1, 2 and 4 in the eastern Atlantic.

Distribution.—Subtropical and temperate regions of the Atlantic and Pacific Oceans (Stebbing, 1888; Chevreux & Fage). The present records are, of course, tropical and hence outside these limits.

Euprimno macropus Stebbing. (Stebbing, 1888; Chevreux & Fage, 1925).—Taken in 15 hauls, principally in Region 4 but found in all regions except 6.

Distribution.—Widely distributed in the three great oceans and also found in the Antarctic (Barnard, 1932).

Eupronöe intermedia Stebbing. (Stebbing, 1888).—Taken in 32 hauls. Did not occur in great numbers in any regions, reaching only a very small maximum in Period 12, but it was fairly evenly distributed across the ocean without any marked preference for either side.

Distribution.—Previously recorded by Stebbing from the tropical Atlantic (1° 47' N., 24° 26' W.) but is not mentioned by either Chevreux & Fage or Stephensen. It seems therefore likely to be a strictly tropical form.

Eupronöe maculata Claus. (Stebbing, 1888 as *E. inscripta* Stebbing; Stephensen, 1925).—Taken in four hauls in Regions 1 and 6, but not at intermediate stations.

Distribution.—Tropical and subtropical regions of the three great oceans (Barnard, 1932).

Eupronöe sp.—In longitudes 20° 56' W. and 24° 38' W. specimens were taken which, while closely resembling those figured by Stephensen (1925, p. 157) as *E. maculata* female, differed in that the terminal segment of the 7th pereopod was much swollen posteriorly. In view of the lack of accord between Stephensen's own figure and that of Stebbing (1888) on this point it seems likely that the presence or absence of such a swelling is a variable character within the species; but this is at present uncertain. Length of *Petula* specimens, 8 mm.

Hemityphis rapax M-Edw. (Stebbing, 1888, as *H. tenuimanus* Claus).—A single specimen in Period 7 (14° 06' N., 27° 44' W.). The basal segment of the 6th pereopod was notched on the distal corner of the fore margin.

Distribution.—Atlantic, 41° N.—38° S., but not between 15° N. and 15° S.; Indo-Pacific (Barnard, 1932). The present record extends this range a little.

Hyperia fabrei (M.-Edw.). (Vosseler, 1901).—Taken in 44 hauls. A maximum occurred in Period 1 and the species was moderately represented in Region 2, after which its numbers fell away to a low level, where they remained with only small fluctuations until the end of the voyage.

Distribution.—Tropical and temperate Atlantic, Indian Ocean without special locality (Stephensen, 1924).

Hyperia latissima Bovallius. (Chevreux & Fage, 1925).—Taken in 19 hauls. Found in all regions except 5, but more commonly in the eastern Atlantic, especially Region 1.

Distribution.—Tropical and subtropical Atlantic (Stephensen, 1924).

Hyperia schizogeneios Stebbing. (Chevreux & Fage, 1925).—Taken in 12 hauls and found in all regions except 4. Although in small numbers it was fairly evenly distributed across the ocean.

Distribution.—Tropical and subtropical Atlantic; a single specimen from the Pacific (Stephensen, 1924; Barnard, 1930).

Lycaea bovalliioides Stephensen. (Stephensen, 1925; Barnard, 1930).—Found only in positions 12° 35' N., 50° 12' W. (1 male) and 12° 44' N., 51° 32' W. (1 female); these positions are in Region 6.

Distribution.—Eastern Mediterranean, eastern Atlantic between 32° N. and 37° N. (Stephensen). The present records lie well outside these limits.

Lycaeopsis themistoides Claus. (Chevreux & Fage, 1925).—Taken in seven hauls, mostly in the coastal waters of the eastern Atlantic, but found also in Regions 4, 5 and 6. The specimens taken by us differed from that described by Chevreux & Fage in the form of the dactyl of the 7th pereopod, which was pointed at the tip and swollen at the base to give it a claw-like outline.

Distribution.—Previously known only from the Mediterranean and from the North-east Atlantic (Chevreux & Fage).

Oxycephalus piscator M.-Edw. (Bovallius, 1890).—Taken in 13 hauls. Found the width of the ocean, but only in small numbers; it was commoner on the eastern side than on the western.

Distribution.—Tropical and temperate regions of the three great oceans (Bovallius; Stephensen, 1925).

Paraphronima gracilis Claus. (Chevreux & Fage, 1925).—Taken in 11 hauls. Found in the eastern Atlantic as far west as Region 3. Thereafter it was found only once, in Period 22.

Distribution.—Tropical and temperate regions of the three great oceans (Stephensen, 1924; Chevreux & Fage).

Parascelus Zebu Stebbing. (Stebbing, 1888; Stephensen, 1925).—Taken in 19 hauls. Fairly evenly distributed across the ocean, being taken in all regions, but never in great numbers.

Distribution.—North tropical and temperate Atlantic, Philippines (Stephensen).

Parathemisto sp.—I have tentatively ascribed these specimens, taken in Periods 2, 14 and 23, to *P. pacifica*, Stebbing (1888). They were of the genus *Parathemisto* s. str. *vide* Barnard, 1930, p. 419, and appeared closely to resemble Stebbing's description of *pacificus*. Unfortunately no figure appears with his account and his description is not entirely clear; until further study is made identification must include a mark of doubt.

Distribution.—Stebbing's specimens came from the Pacific in 35° N., 154° W.

Paratyphis clausii Stephensen. (Stephensen, 1925).—Found close to the African coast in longitudes 19° 34' W. and 19° 40' W.; and in longitude 34° 31' W., in Region 4.

Distribution.—Previously known only from the Mediterranean and from 'Hongkong-Shanghai' (Stephensen).

Paratyphis promontorii (Stebbing). (Stebbing, 1888; Stephensen, 1925).—Taken in three hauls in Region 6.

Distribution.—Tropical and subtropical Atlantic. (Stephensen).

Phronima atlantica Guérin. (Vosseler, 1901; Chevreux & Fage, 1925).—Taken in six hauls. Found in Regions 1 and 2, and early in Region 5, never in great numbers.

Distribution.—Tropical and subtropical regions of the three great oceans (Stephensen, 1924).

Phronima colletti Bovallius. (Vosseler, 1901; Chevreux & Fage, 1925).—Taken in ten hauls. Although never numerous it was fairly evenly distributed across the width of the ocean, occurring in every region.

Distribution.—Tropical and subtropical regions of the three great oceans (Stephensen, 1924).

Phronima sedentaria (Forsk.). (Vosseler, 1901; Chevreux & Fage, 1925).—Found once each in Periods 5 and 6 in Region 2.

Distribution.—Tropical and temperate regions of the three great oceans (Stephensen, 1924).

Phronima stebbingi Vosseler. (Vosseler, 1901; Chevreux & Fage, 1925).—Found in 15 hauls mainly in the eastern Atlantic; it disappeared shortly after the end of Region 4 and did not reappear until Region 6.

Distribution.—Tropical and temperate Atlantic (Stebbing, 1888; Vosseler, 1901).

Phronima elongata Claus. (Vosseler, 1901; Chevreux & Fage, 1925).—Taken in 29 hauls; thinly and evenly distributed across the ocean, being only slightly better represented on the eastern side than on the western.

Distribution.—Tropical and temperate regions of the three great oceans (Stephensen, 1924).

Phrosina semilunata Risso. (Stebbing 1888; Chevreux & Fage, 1925).—Four specimens were taken in longitude 34° 31' W. in Period 13.

Distribution.—Tropical and temperate regions of the three great oceans (Stephensen, 1924; Chevreux & Fage, 1925).

Platyscelus armatus (Claus).—Taken in four hauls, in Periods 5, 6 and 13.

Distribution.—Tropical Atlantic (Stebbing, 1888). This species may be identical with *P. rissoinae* Sp. Bate, which is known from the tropical Pacific.

Platyscelus serratulus Stebbing. (Chevreux & Fage, 1925).—Taken in six hauls. Found in Periods 3, 6, 8, 21 and 24, i.e. not in mid-ocean.

Distribution.—Tropical and temperate north Atlantic; Indian Ocean (Stebbing, 1888; Chevreux & Fage).

Pseudolycaea pachypoda Claus. (Chevreux & Fage, 1925; Stephensen, 1925).—Taken in 13 hauls. Although not found west of the mid-longitude of the voyage ($38^{\circ} 22'$ W.) this species occurred in considerable numbers in Region 4 and was also represented, although less strongly, in each of the preceding regions.

Distribution.—Known from the temperate Atlantic and from Zanzibar. It is very common in the Mediterranean (Stephensen). No previous report from the tropical Atlantic.

Rhabdosoma brevicaudatum Stebbing. (Stebbing, 1888; Bovallius, 1890, as *Zyphocephalus brevicaudatum* (Stebbing).—Taken in three hauls, all in Region 1.

Distribution.—Tropical and north subtropical Atlantic (Stephensen, 1925).

Rhabdosoma whitei Sp. Bate. (Bovallius, 1890, as *Zyphocephalus whitei* (Sp. Bate)).—Taken in three hauls in Regions 1 and 2.

Distribution.—Tropical and subtropical regions of the three great oceans (Stephensen, 1925).

Scina crassicornis (Fabr.). (Chevreux & Fage, 1925).—Taken in 12 hauls. Found between Periods 13 and 23 in Regions 5 and 6.

Distribution.—Tropical and subtropical Atlantic and Indian Oceans, perhaps also the Pacific (Stephensen, 1918).

Sympronoe parva Claus. (Stebbing, 1888; Stephensen, 1925).—Stephensen recorded nine specimens from the *Thor* material, bringing the total mentioned in the literature to about 14. Aboard the *Petula* we took only a single specimen, in longitude $24^{\circ} 48'$ W. This was a female resembling Stebbing's form i.e. with a short segment terminating the 7th pereopod.

Distribution.—Tropical regions of the three great oceans, Mediterranean and also eastern Atlantic at 34° N. (Stephensen; Barnard, 1932).

Tetrathyrus forcipatus Claus. (Chevreux & Fage, 1925).—Taken in 33 hauls. This species, nowhere numerous, was generally commoner in coastal than in oceanic water. It was moderately represented in Regions 1, 2 and 4 and again in Region 6.

Distribution.—Tropical and temperate regions of the Atlantic and Indian oceans, Red Sea (Stephensen, 1925).

Vibilis armata Bovallius. (Stephensen, 1918).—A few in longitude $23^{\circ} 15'$ W., Region 1.

Distribution.—Tropical and temperate regions of the three great oceans (Stephensen; Chevreux & Fage, 1925; Barnard, 1932).

Vibilia gibbosa Bovallius. (Vosseler, 1901).—Longitude $51^{\circ} 00'$ W., in Region 6; a single specimen.

Distribution.—Tropical and temperate Atlantic. A rare species (Stephensen, 1918).

Vibilia jeangerardi Lucas. (Stephensen, 1918).—Taken twice in Region 4.

Distribution.—Tropical and temperate Atlantic Ocean, tropical Indian Ocean (Stephensen).

Vibilia propinqua Stebbing. (Stebbing, 1888; Stephensen, 1918).—Taken only in a single haul, in longitude $33^{\circ} 26'$ W., Region 4.

Distribution.—Tropical and temperate regions of the three great oceans (Stephensen; Barnard, 1932).

Vibilia viatrix Stebbing. (Stebbing, 1888; Stephensen, 1918).—Taken in 15 hauls, fairly evenly distributed across the width of the Atlantic.

Distribution.—Tropical and temperate regions of the three great oceans (Stephensen; Barnard, 1932).

MYSIDACEA

Anchialina typica Kröyer. (Hansen, 1910).—Taken in nine hauls in the western part of the Atlantic, in Regions 5 and 6.

Distribution.—Reported from the tropical regions of the Indo-Pacific (Hansen) and Atlantic (Tattersall, 1926) Oceans. However, although a high-oceanic form it appears absent from the eastern Atlantic.

Siriella thompsonii M.-Edw. (Sars, 1885).—Taken in nine hauls. Occurred at long intervals along the length of the route, but was taken most frequently in Region 6.

Distribution.—Tropical and subtropical regions of the three great oceans (Hansen, 1910; Tattersall, 1951).

EUPHAUSIACEA

Euphausia americana Hansen. (Hansen, 1911).—Taken in 91 hauls. Densest in eastern and western coastal waters, but present almost throughout the route.

Distribution.—Found over much of the tropical and temperate Atlantic (Hansen, 1915). Appears not to have been recorded from other oceans.

Euphausia mutica Hansen. (Hansen, 1910).—Taken in longitudes 20° 38' and 20° 52' W., in Region 1.

Distribution.—Tropical and subtropical regions of the three great oceans (Hansen; Tattersall, 1939). Comparison of present and past records suggests a neritic habitat.

Euphausia pseudogibba Ortmann. (Hansen, 1910).—Longitude 23° 15' W. in Region 1, a single adult male.

Distribution.—Eastern tropical and temperate Atlantic north of the equator, tropical Indian and Pacific Oceans (Hansen, 1912). It does not appear to have been taken in the western Atlantic.

Euphausia tenera (Hansen). (Hansen, 1910).—Taken in 115 hauls, well represented across the width of the Atlantic. The commonest euphausiid in the collection.

Distribution.—Tropical and subtropical regions of the three great oceans (Hansen).

Nematoscelis sp.—A single subadult male of this genus was found in Period 8.

Stylocheiron carinatum Sars. (Sars, 1885; Hansen, 1910, 1911).—Taken in 72 hauls. Present only in moderate numbers until Region 4. It was well represented in this region and in Region 6, being generally commoner in the western Atlantic than the eastern.

Distribution.—Widely distributed in the three great oceans (Hansen, 1915).

Thysanopoda tricuspidata M.-Edw. (Sars, 1885; Hansen, 1910).—Taken in 55 hauls. Moderately represented along the length of the route. It occurred in greatest number at Period 15 in Region 5, where plankton generally was somewhat sparse.

Distribution.—Tropical and subtropical regions of the three great oceans (Hansen).

DECAPODA

Lucifer sp. (For an account of the claims of the synonyms *Lucifer* and *Leucifer* see Barnard, 1950; 644).—Two females having proportionately short eye-stalks were taken, one in longitude 20° 56' W., and the other in longitude 51° 09' W. The former was without telson or uropods. I have tentatively ascribed them to *L. penicillifer* Hansen, 1919.

Distribution of L. penicillifer.—Tropical Indo-Pacific (Hansen); S. African waters (Barnard, 1950).

Lucifer typus M.-Edw. (Hansen, 1911).—Taken in 98 hauls. Moderately represented across the width of the Atlantic, with rich concentrations occurring locally in both oceanic and coastal waters. The records suggest that it may be a little commoner in the eastern Atlantic than in the western.

Distribution.—This species has been confused with *L. orientalis* in the Indian Ocean, where the latter is much commoner. However, *L. typus* has been reported from the tropical regions of the three great oceans and from the sub-tropical Atlantic. It appears to be strongly stenothermal.

Sergestes atlanticus M.-Edw. (Hansen, 1922).—Taken in 82 hauls. Present the width of the Atlantic, with a slight emphasis on the eastern half. Unlike the other pennaeid, *Lucifer*, it was poorly represented in Region 4.

Distribution.—Tropical and subtropical regions of the three great oceans (Hansen). A stenothermal species.

Sergestes corniculum Krøyer. (Hansen, 1922).—Acanthosoma stages only were found twice in Period 1.

Distribution.—Tropical and temperate Atlantic, tropical Indian and Pacific Oceans (Hansen).

(LARVAL DECAPODA)

HOPLOPHORIDAE (*Acantheephyra* larvae). (Gurney, 1924, 1942).—Taken in 22 hauls, in all regions except Region 5.

AMPHIONIDAE. (Gurney, 1936).—Found in Regions 1 and 2 and very few from Period 23 in Region 6.

ARISTAENID mysis.—A specimen resembling the second mysis stage of *Gennadus* sp. figured by Gurney (1924: 57) was taken in longitude 19° 53' W. Gurney's specimen was caught off North Island, New Zealand.

HIPPOLYTIDAE. (Gurney, 1937).—Taken in seven hauls in Regions 1, 2 and 6. Gurney (1942) writes, 'It does not seem that there is any purely larval character by which the Pandalidae can be separated on the one hand from the Hippolytidae and on the other from the Processidae.' However, at all *Petula* stations except one, the samples were of the larval genus *Eretmocaris* which is usually placed with the Hippolytidae.

MEGALOPA larvae.—Found only in five hauls, in Regions 1 and 2.

NEPHROPSIDAE.—Longitude 23° 13' W., in Region 1, a single specimen.

PALAEMONIDAE (*Retrocaris*).—Taken in eight hauls between longitudes 22° 58' W. and 25° 38' W. and again in longitude 50° 22' W. specimens resembling the *Retrocaris* form described by Gurney (1924: 123) were taken. Gurney's specimens were taken to the NE. of Rio de Janeiro, also within the tropics.

PHYLLOSOMA larvae.—Taken in five hauls. There is evidence that these larvae were able to avoid our plankton nets, for they were caught with greater frequency by our 1 m. diameter young fish net. The limits of their range given in Table III are nevertheless approximately correct, since they are confirmed by the catches of the larger net.

STENOPIDEA. (Gurney, 1924).—Taken in 13 hauls. These forms, perhaps *Stenopus* sp., extended from the eastern shores of the Atlantic to almost the mid-longitude (38° 22' W.) occurring in Regions 1, 2, 3 and the early part of 5.

Oddly, they were absent from the rich Region 4. A few specimens were taken in Region 6.

THALASSINIDAE.—Specimens resembling Gurney's (1938: 310) from D IV from the *Discovery* station 1581 were taken in longitudes 19° 34' W. and 24° 57' W. in Regions 1 and 2 respectively.

ZOEALARVAE.—Found in 11 hauls in Regions 1 and 2. The specimens were of three types; a porcellanid; and two brachyurans, perhaps *Inachus* sp. and *Thia* sp.

STOMATOPODA

PSEUDZOEA.—Taken in nine hauls in Regions 1 and 2; these were probably larval *Squilla* sp. They disappeared after longitude 25° 35' W. together with some of the decapod larvae.

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A NOTE ON THE EXPERIMENTAL TAXONOMY OF *DACTYLIS* L.: MATERIAL IN THE HERBARIUM OF THE WELSH PLANT BREEDING STATION, ABERYSTWYTH

By MARTIN BORRILL, Ph.D., F.L.S.

DURING recent studies of the diploids, and of the polyploid complex in *Dactylis* L. a considerable number of populations of wild plants have been grown at Aberystwyth, and a large number of hybrids have been made. Some detailed results have been published by the Society. (Borrill, M., 1961, *J. Linn. Soc. (Bot.)* **56** (368) : 431-439 (3 pls.), 441-452 (1 pl.), 453-458 (1 pl).)

The Welsh Plant Breeding Station herbarium is being extended and rehoused, under the charge of Dr Martin Borrill, and so that the material used in the *Dactylis* study may be more readily accessible, a cyclostyled list has been prepared, copies of which may be obtained from the station on request.

Systematics*General Account*

	£	s.	d.	
INCOME				
Balance at Westminster Bank, 15.v.59	209	16	9	(239)
Annual subscriptions @ 5/-, 242 (146)	60	10	0	(37)
Annual subscriptions @ 10/-, 8	4	0	0	
Member's credit		5	0	
Clarendon Press: royalties on <i>The New Systematics</i>	20	17	2	(20)
Sales by Hon. Treasurer of Publication No. 1	15	16	6	(12)
Sales by Hon. Treasurer of Publication No. 2	24	16	0	(54)
Sales by Hon. Treasurer of Publication No. 3	25	11	1	
Transferred from Special Account	400	0	0	
Received from authors for separates	13	4	0	
	<u>774</u>	<u>16</u>	<u>6</u>	

Special Account

Balance in Post Office Savings Bank, 15.v.59	587	8	8	(416)
Interest 1959	14	9	3	(10)
Life memberships 3	15	0	0	(20)
Sale of Publication to life member		6	0	
Sales by Agents of Publication No. 1	15	6	3	(23)
Sales by Agents of Publication No. 2	52	1	3	(89)
Sales by Agents of Publication No. 3	10	18	9	
Due from General Account	150	10	11	
Difference in Special Account	4	1	11	
	<u>850</u>	<u>3</u>	<u>0</u>	

Balance sheet

LIABILITIES				
Founder and Life members 65 (62)	325	0	0	(310)
Annual subscriptions in advance @ 5/-, 55	13	15	0	(19)
Annual subscriptions in advance @ 10/-, 8	4	0	0	
Expenses of Botanical Secretary, 1958-60	1	10	10	
Printing of annual reports and accounts (est.)	15	0	0	
Excess assets over liabilities	683	10	9	(678)
	<u>1042</u>	<u>16</u>	<u>7</u>	

Audited and found correct

E. MILNE-REDHEAD

23 May 1960.

Association

1959-60

EXPENDITURE

	£	s.	d.	
Institute of Biology: secretarial services and materials, 1.iv.59-31.iii.60	42	19	4	(37)
Hon. Treasurer's expenses, 27.iv.59-30.iv.60	6	1	5	(4)
Hon. Zoological Secretary's expenses, 2 years to 30.iv.60	8	9	1	
Subscription to Biological Council		15	0	
Publications distributed to members	—	—	—	(19)
Ryman: receipt books	13	15	9	
Milner: statement forms for publication sales	3	16	7	
O.U.P.: printing of Publication No. 3	502	0	0	
O.U.P.: authors' separates	52	12	10	
Balance at Westminster Bank, 10.v.60	144	6	6	(210)
	<u>774</u>	<u>16</u>	<u>6</u>	

1959-60

Balance in Post Office Savings Bank, 30.iv.60	295	10	2	(587)
Withdrawn from Post Office Savings Bank, 6.iv.60	400	0	0	
Due to General Account	154	12	10	
	<u>850</u>	<u>3</u>	<u>0</u>	

May 10 1960

ASSETS

Balance in Post Office Savings Bank	295	10	2	(587)
Balance at Westminster Bank	144	6	6	(210)
Subscribers 1 year in arrear, 50 @ 4/-	10	0	0	(12)
Subscribers 2 years in arrear, 18 @ 4/-	3	12	0	(8)
Publication No. 1 : 261 copies	53	15	11	(85)
Publication No. 2 : 915 copies	30	18	10	(108)
Publication No. 3 : 1867 copies	465	4	4	
Due from authors for separates	39	8	10	
	<u>1042</u>	<u>16</u>	<u>7</u>	(1011)

Previous year's figures, where relevant, are given in brackets.

G. J. KERRICH
Honorary Treasurer

NOTES FOR AUTHORS

Careful attention to these notes can accelerate consideration, acceptance and publication of papers.

1. Study the arrangement and conventions of the journal in which your paper is to appear.

2. *Papers* must be concise. Adventitious material, relevant in doctoral theses, is seldom acceptable for publication.

3. In addition to MS. of text, attach an *abstract* or *summary* of contents in triplicate of about 200/100 words, without any illustrations or references, on separate sheet of paper from main text.

4. Include a *Table of Contents*, whether publication is desired or not, on separate sheet of paper from main text. Table should show complete hierarchy of headings as discussed in note 6 below and have MS. folio numbers entered on it.

5. *Copy*, including legends for illustrations, graphs, etc., should be typewritten, double-spaced or, better still, treble-spaced, on one side of uniformly sized paper (Qto./Flscp.). Leave $1\frac{1}{2}$ to 2 inch margin on left-hand side of each folio for printer's marks and editorial use generally.

Positions of all figures, graphs and tables must be indicated in left-hand margin; preferably they should all be referred to in the text.

Send top-copy for editorial use; retain fully corrected carbon-copy so that MS. need not be transmitted in course of correspondence about paper. Number folios on top right-hand corner.

6. Hierarchy of *headings*, exclusive of side headings to paragraphs, should not exceed three. Headings should be in ordinary typescript, not underlined or marked with any printer's symbols, and without a concluding stop. Side headings should be underlined. Use ordinary English alphabetic letters or Arabic numerals if headings are serialized.

7. Avoid *footnotes* and use of small type for passages within the text. Keep *cross-references* by page number at a minimum.

8. Underline *generic names* and *specific epithets*, subgeneric, section and other usually latinised names for taxonomic segregates in text but leave unmarked in lists, tables, etc. Give author of name when it is first used or in most prominent place in text.

9. Avoid unusual *symbols*. Where possible use ordinary English alphabetic letters or arabic numerals. For graphs, etc. the following standard symbols are available: Δ , $\blacktriangle$, $\bullet$, $\circ$, $\square$, $\times$, $\odot$. Avoid use of Greek letters and Latin numerals. Mathematical expressions, equations, etc. should be on individual lines of text and not arranged to run on with ordinary textual matter.

10. Give *references* in the text in the following forms:—'Barlow (1855) said ...', 'Barlow (1855 : 140)' where it is desired to refer to a specific page, and '(Barlow, 1855)' or '(Barlow, 1855 : 140)' where giving reference simply as authority for a statement.

In list of References the form should be:—Barlow, W. F. 1855. Observations on the respiratory movements of insects. *Phil. Trans.*, **145** : 139–148. (Underline vol. No. wavy to indicate bold face.)

Underline title of journal or book to indicate italic face. Wherever possible abbreviate titles of journals in accordance with *World List of Scientific Periodicals*. Do not abbreviate titles of books but add place of publication with indication of edition if other than first. In purely systematic papers subject-titles of papers in journals may be omitted at author's discretion or editorial decision.

Give *foreign language* references in ordinary English alphabetic form, if necessary transliterating in accordance with recognized transliteration scheme. Thus, for transliteration of the Cyrillic alphabet (used in Russian, Serbian and Bulgarian) authors should use the "British" system prepared by the Royal Society. This "British" System is also available from the British Standards Institution as publication "British Standard: 2979: 1959".

The Editorial Committee will assume that authors have checked the correctness of abbreviations of titles and transliterations as suggested above except when authors indicate that they cannot get access to the necessary literature.

Avoid the use of 'Ibid.' 'l.c.' etc.; repeat the references as earlier in MS.

11. *Keys* should be in one of the generally accepted forms. The following type of key is informative, and economical in respect of printing cost.

- | | | |
|-------|---|-------------------------------|
| 1 | Pelage white | 2 |
| – | Pelage brown | 4 |
| 2 (1) | Tail bushy; occurs only in <i>Araucaria</i> forest at altitudes above 5000 ft | |
| | browni Smith, p. 80 | |
| – | Tail naked; never in <i>Araucaria</i> forest..... | 3 |
| 3 (2) | Nose pink | robinsoni Jones, p. 70 |
| – | Nose black..... | 5 |
| 4 (1) | Eyes blue | jonesi Robinson, p. 60 |
| – | Eyes red | smithei Brown, p. 50 |

[P.T.O.]

12. *Illustrations* should be black and white, waterproof indian ink drawings, suitable for line-block reproduction. Illustrations requiring half-tone or colour work should only be used by arrangement; both are expensive and this may operate against acceptance of a paper unless some subvention is available. Scrapper-board illustrations are unacceptable unless of perfect technical quality.

Black-and-white drawings should be in clean, even width, lines such as are produced by engineer's or architect's mechanical drawing pens or stylographic pens; the fine strokes of mapping and sketching pens do not reproduce so well. To delete use 'Process White' not 'Chinese White'. The most satisfactory figures are made from drawings on Bristol Board with the lettering indicated lightly in pencil or on an attached piece of tracing material. In such cases the lettering will be inserted by the blockmaker. If drawings are submitted on plastic or other tracing films the lettering should be finished by the author and great care taken that lines are well inked. There are available proprietary inks especially suited for drawing on plastic sheets. The preparation of blocks from drawings on such films, especially the insertion, by the block maker, of lettering thereon, presents some difficulties and so causes additional expense.

When lettering a drawing avoid using abbreviations. Use single letters or numbers or whole words. If abbreviations are used they should be the same as any used in the text.

Space available for illustration on a whole page including legend(s) is:—*Journ. Bot.* : 8 × 5 inches (20 × 13 cms.); *Journ. Zool.* : 7½ × 5 inches (19 × 12.5 cms.); *Proc.* : 7½ × 4½ inches (19 × 11.5 cms.)

Size of drawings should allow for a standard reduction in blockmaking of ½ linear or by ¼ linear (drawings needing no reduction will also be accepted). Indicate scale, where final figure is less than natural size, by a vulgar fraction in legend. Where there is a magnification, indicate with a line representing 1 mm. or 1 cm. or other metric unit along side actual figure.

Authors wishing to borrow published illustrations must add the postal address of the publisher to the precise reference to the author's work, fig., legend, page, date, etc.

To permit convenient handling by post, etc. original drawings, or cards upon which drawings are mounted, should be of reasonable size, e.g. quarto, foolscap; if larger, even when delivered by hand, they should be within the Post Office size limits (length 3 ft. 6 in.; length and girth combined 6 ft) when packed in parcel.

13. *Graphs* are usually reproduced as though they were line drawings for text-figures. Paper should be ruled blue if not to show in graph as printed; black if to be reproduced. See note 9 above about use of symbols.

14. Avoid elaborate *tables*, they are expensive to print especially if requiring use of vertical rules (actual printed vertical lines). Consider use of indented paragraphs with brief side headings for tabular statements rather than boxed text. Hanging indentation of paragraphs must not be used. See note 9 above about use of symbols.

15. Submit MS. in finalized, fully revised and corrected form otherwise author may be liable for some part of cost of *proof corrections*. Assume that in proof only actual errors of typography or of fact can be corrected; proofs are not the place for alterations on account of style.

16. Adhere strictly to *International Rules of Nomenclature*. All statements about type material, type locations, etc. must be unequivocal.

17. In papers by *joint authors* indicate clearly extent of responsibility of different authors. One author must accept the responsibility for paper in respect of correspondence about publication.

18. Papers in *languages* other than English are not usually accepted for publication unless invited or the sole author is one of the Society's (Honorary) Foreign Members.

19. Manuscripts are given editorial consideration on the understanding that their *contents* will not appear elsewhere in substantially same or abbreviated form. If there has been a preliminary announcement about the contents (e.g. in a letter to *Nature*) this must be stated. It can be very helpful and speed-up consideration of a MS., if authors confidentially inform the Editorial Secretary when MS. or a similar one has been previously offered elsewhere and not accepted.

20. *Copyright* of Text and Illustrations of all sorts vests in the Society.

21. The Royal Society, London, have published a useful booklet on 'General Notes on the Preparation of Scientific Papers'.